JOURNAL

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CEYLON BRANCH

OF THE

ROYAL ASIATIC SOCIETY,

1885—1886.

VOLUME IX.

EDITED BY THE HONORARY SECRETARY.

"The design of the Society is to institute and promote inquiries into the History, Religion, Literature, Arts, and Social Condition of the present and former Inhabitants of the Island, with its Geology, Mineralogy, its Climate and Meteorology, its Botany and Zoology."

COLOMBO:

G. J. A. SKEEN, GOVERNMENT PRINTER, CEYLON.

1888.

CONTENTS OF VOLUME IX.

ERRATA ET ADDENDA.

Page 351, note ‖, *for* "p. 124" *read* "p. 62."
" 352, line 2, *for* "Van Goen" *read* "Van Goens."
" 353, note ‡, *for* "Norasa" *read* "Novasa."
" 358, note *, *for* "p. 123" *read* "p. 62."
" 358, note †, *for* "p. 126" *read* "p. 63."
" 359, line 30, *for* "Taylor" *read* "Tylor."
" 359, note *, *omit* "Die omfänge der cultur übers."
" 359, note †, *for* "Taylor" *read* "Tylor."
" 359, note †, *for* "Spang" *read* "Spangel."
" 368, note †, *for* "Zuitf." *read* "Zeits. für" *passim.*
" 378, note *, *for* "Mokna" *read* "Mokua."
" 381, line 2, *for* "Ḙlu" *read* "Eḷu."
" 381, note *, *for* "p. 104" *read* "p. 61."
" 384, line 12, *for* "κολορα" *read* "κολοβὰ."
" 387, last line, *after* "precipices" *insert* "(λιθίνοις σπηλαίοις)."
" 388, line 16, *for* "Zvortvan berwe beandend," &c., *read* "Zwart van verwe, brandend," &c.
" 394, line 6, *after* "Skull No. 1" *insert* "(Table I.)."
" 394, line 11, *for* "Dewilané" *read* "Denilane."
" 398, line 13, *for* "Busle" *read* "Busk."
" 398, line 14, *for* "two last" *read* "last two."
" 398, line 31, *after* "Museum," *insert* "(Table I., Fig. 3)."
" 399, line 21, *for* "Weleker" *read* "Welcker."
" 402, line 11, *for* "*occipitale*" *read* "*occipitalis.*"
" 404, line 10, *for* "76" *read* "7·6."
" 404, line 12, *after* "skull" *insert* "(Flower, No. 683)."
" 406, line 16, *for* "chamæprosopous" *read* "chamæprosopic."
" 406, line 29, *after* "skull," *insert* "(No. 675)."
" 406, line 35, *for* "alreolar" *read* "alveolar."
" 406, line 36, *for* "basilar alvesli" length *read* "basi-alveolar length."
" 407, line 2, *for* "basinasel" *read* "basinasal."
" 409, line 2, *for* "Bernard" *read* "Barnard."
" 411, line 18, *for* "von" *read* "van."
" 411, line 19, *for* "vrijser ruf tig" *read* "vrij vernuftig."
" 411, note *, *for* "Tambulus" *read* "Jambulus."

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CONTENTS.

EXPLANATORY NOTE.

The *Natural Orders* and the *Genera* in this Catalogue are each numbered consecutively throughout, the sequence followed being that of the "Genera Plantarum" by Bentham and Hooker. The *Species* are generally named in accordance with the "Flora of British India," so far as that work has yet been published (to end of Genus 594, p. 67).

Names of species or varieties printed in SMALL CAPITALS are believed to be *endemic* (i. e., found in Ceylon only, or peculiar to the Island).

Names with an asterisk (*) prefixed are exotic species which have become more or less *naturalized*, usually as *weeds* in cultivated or waste land. Many are thoroughly established and very common; others merely casual and rarely found. A dagger (†) prefixed to a name indicates a suspicion of exotic origin or a doubt as to true nativity.

Names enclosed in round brackets ( ) are exotic species which, being largely *cultivated* for use or ornament, are often found apparently wild, but are not really naturalized here.

A query (?) prefixed to a name indicates doubt as to the occurrence of the plant in Ceylon; placed *after* a name it means doubt as to the correctness of the determination.

Names enclosed in square brackets [ ] are species which have been recorded for Ceylon, but the occurrence of which is a matter of grave doubt or requires verification. Most of them are, in all probability, *errors*, but as they are given in books of more or less authority, it is thought well to include them, thus clearly distinguished from the others.

The additional names (synonyms) in *italics* are those of Thwaites's "Enumeratio Plantarum Zeylaniæ" (1858–64) when different from the ones here adopted. The numbers following the names refer to the pages of the same book, to which this Catalogue forms a complete classified index.

In the case of a few species of which I have not seen Ceylon specimens—and for the most part not included in the "Enumeratio"—I have quoted the name of the collector given by the author recording the species as Ceylonese,

thus ("Walker"). Most of them, it will be seen, were collected by Col. or Mrs. Walker (in 1830–40), and many, it seems, have not been again found.

"C. P." refers to the distributed sets of dried specimens of *Ceylon Plants.* The numbers given here are the whole of those subsequent to the ones quoted in the "Enumeratio," which terminated with C. P. 3860. A few of the earlier numbers however are occasionally quoted in this Catalogue, when necessary to secure precision in nomenclature.

New Species.—There are a few MS. names here printed for the first time. It is my intention to publish descriptions of these supposed new species in the "Journal of Botany" (London) without delay.

Vernacular Names.—The letters "S." and "T." after these signify *Siṇhalese* and *Tamil* respectively. With regard to the former, it is believed that a fair amount of accuracy has been attained, and that the spelling is in accordance with the rules for transliteration prescribed by the Ceylon Government. In the case of the Tamil names, however, it is to be feared that but a small number of those in use in the North and East of the Colony have been obtained, and that these are not always rightly determined or properly transliterated. But it may be hoped that the publication of this list will serve as a basis for a more systematic and accurate collection.

English names have been added to the few plants which have acquired them.

H. T.

Péradeniya, February, 1885.

Corrections and Additions.

PAGE 2, No. 15; *Cyathocalyx zeylanicus* is not endemic, and should not be printed in small capitals.

13, line 8 from bottom; add at end of line, 54.

22, line 7 from bottom; insert before 410, *Var. β*.

38, line 8 from bottom; for "*Cerasiocarpus*" read *Cerasiocarpum*.

44, line 19; after var. pubescens add, *Var. β*. 155.

54, line 19; for "L." read, and.

ib., line 4 from bottom; after *Rothii* insert, var. *puberula*.

ib., line 15 from bottom; for "*Pori*" read *Poir*.

55, line 12 from bottom; add at end of line, 197.

ib., line 18 from bottom; for "*Mẹda-kangu*" read *Mẹda-hangu*.

56, line 6; add at end of line, 196.

64, line 16; for "20" read 208.

79, line 15 from bottom; for "*P. flexuosus*" read *Peltandra flexuosa*.

81, line 13; for "trilboa" read triloba.

82, line 2; before 271 insert, *C. longifolium*.

86, line 16; add at end of line, 294.

96, line 13; for "*fasciculata*" read *fasciculatum*.

89, after line 27, insert

794 bis. OCTARRHENA PARVULA, *Thw.* 305.

104, line 11 from bottom; for "P. infidum, *Steud.?*" read P. glumare, *Trin.* (This grass is *Urochloa glabra*, Brongn.)

105, line 11; for "3090" read 3890.

Add to Index in its proper place:—

Peltandra . . 695.

DICOTYLEDONS.

POLYPETALÆ THALAMIFLORÆ.

1. Ranunculaceæ.

1. Clematis smilacifolia, *Wall.* 1.
   Nara-wẹl, S.
   C. Gowriana, *Roxb.* 1.
2. Naravelia zeylanica, *DC.* 1.
3. Anemone rivularis, *Ham.* 1.
4. Thalictrum javanicum, *Bl.* *T. glyphocarpum.* 1.
5. RANUNCULUS SAGITTIFOLIUS, *Hk.* 1.
   R. Wallichianus, *W. & A.* 1.

2. Dilleniaceæ.

6. Delima sarmentosa, *L.* 2.
   Korasa-wẹl, S.
7. Tetracera lævis, *Vahl.* 2.
   Ẹt-korasa-wẹl, S.
8. ACROTREMA UNIFLORUM, *Hk.* 2. & C.P. 3896.
   var. rotundatum, *Thw.*
   var. bullatum, *Thw.* (sp.) 2.
   var. rugatum, *Thw. ms.* (sp.) C.P. 3899, 3905.
   var. sylvaticum, *Thw.* (sp.) 2. & C.P. 3882.
   var. (? hybr.) membranaceum, *Thw. ms.* (sp.) C.P. 3897, 3898.
   var. Walkeri, *Thw.* (sp.) 3, 398.
   var. (? hybr.) appendiculatum, *Thw. ms.* (sp.) C.P. 3880.
   var. (? hybr.) dentatum, *Thw. ms.* (sp.) C.P. 3881.
   A. INTERMEDIUM, *Thw.* 3.
   A. LANCEOLATUM, *Hk.* 3.
   A. GARDNERI, *Thw.* 3.
   A. THWAITESII, *Hk. f. & Th.* 3. & C.P. 3969.
   A. DISSECTUM, *Thw.* 3.
   A. LYRATUM, *Thw.* 3.
9. SCHUMACHERIA ANGUSTIFOLIA, *Hk. f. & Th.* 4.
   S. ALNIFOLIA, *Hk. f. & Th.* 4.
   var. scabra, *Thw.*
   var. dentata, *Wight.*
   var. subglabra, *Thw.*

S. CASTANEÆFOLIA, *Vahl.* 4.
Kẹkiriwará, S.

10. WORMIA TRIQUETRA, *Rottb.* 4.
Diyapara, S.

11. Dillenia indica, *L.* *D. speciosa.* 5.
Hoṇḍapara, Wam-para, S.

D. RETUSA, *Thunb.* 5.
Goḍapara, S. *Pasu, Punali*, T.

3. Magnoliaceæ.

12. Michelia nilagirica, *Zenk.* 5.
Wal-sapu, Wal-buruta, S.
var. glauca, *Wight* (sp.) (Includes var. ovalifolia.)
var. Walkeri, *Wight* (sp.)

(M. Champaca, *L.*) 5.
Sapu, S. *Senpakam*, T. *Champak.*

13. Kadsura Wightiana, *Arn.* 5.

4. Anonaceæ.

14. UVARIA SPHENOCARPA, *Hk. f. & Th.* 6.
U. macrophylla, *Roxb.* 6.
U. semecarpifolia, *Hk. f. & Th.* 6.
U. MACROPODA, *Hk. f. & Th.* 6.
U. Narum, *Wall.* 6.
U. zeylanica, *L.* 6.
Palu-kaṉ, S.

15. CYATHOCALYX ZEYLANICUS, *Champ.* 9.
Kẹkala, I'pẹtta, S.

16. Artabotrys odoratissimus, *R. Br.* 9.
A. zeylanicus, *Hk. f. & Th.* 9.
Petiká-wẹl, S.

17. UNONA ELEGANS, *Thw.* 398.
U. ZEYLANICA, *Hk. f. & Th.* 9.

18. Polyalthia longifolia, *Bedd.* *Guatteria.* 10.
P. coffæoides, *Bedd.* *Guatteria.* 10.
Nedunárai, T.
P. ACUMINATA, *Thw.* 399.
P. Korinti, *Hk. f. & Th.* 10.
Ulavintai, T.
P. suberosa, *Bedd.* 10.
Kalaṭi, S.
P. MOONII, *Thw.* 9.
P. PERSICIFOLIA, *Bedd.* *Guatteria.* 10. C.P. 3917.

19. Anaxagorea luzonensis, *Gray.* *A. zeylanica.* 10. C.P. 3883.

20. Goniothalamus Thwaitesii, *Hk. f. & Th.* 7.
Kalukẹra, S.
G. GARDNERI, *Hk. f. & Th.* 7.
G. HOOKERI, *Thw.* 6.
G. WALKERI, *Hk. f. & Th.* 8.
Kapuru, S.
G. THOMSONI, *Thw.* 7.
G. RETICULATUS, *Thw.* 7.
G. SALICINUS, *Hk. f. & Th.* 7.

21. Mitrephora Heyneana, *Thw.* 8.

22. XYLOPIA PARVIFLORA, *Hk. f. & Th.* 9.
Neṭawu, S.
X. NIGRICANS, *Hk. f. & Th.* 9.
X. CHAMPIONII, *Hk. f. & Th.* 9.
Datkẹṭiyá, S.

23. Miliusa indica, *Lesch.* *M. montana.* 10.
M. ZEYLANICA, *Gardn.* 11.

24. Alphonsea lutea, *Hk. f. & Th.* 399.
A. zeylanica *Hk. f. & Th.* 11.
A. SCLEROCARPA, *Thw.* 11.

25. Orophea zeylanica, *Hk. f. & Th.* 8.

26. BOCAGEA THWAITESII, *Hk. f. & Th.* *Sageræa.* 6.
B. CORIACEA, *Hk. f. & Th.* *Orophea.* 8.
Keku, S.
B. OBLIQUA, *Hk. f. & Th.* *Orophea.* 8.

5. Menispermaceæ.

27. Tinospora malabarica, *Miers.*
var. tomentosa, *Miers* (sp.) 12.
Bú-kinda, Wal-kinda, S.
† T. crispa, *Miers.*
Titta-kinda, S.
T. cordifolia, *Miers.* 12.
Rasa-kinda, S. *Seenthil*, T.

28. Anamirta paniculata, *Colebr.* *A. Cocculus.* 12.
Titta-wẹl, S.

29. Coscinium fenestratum, *Colebr.* 12.
Weni-wẹl, S.

30. Tiliacora racemosa, *Colebr.* *T. acuminata.* 12.

31. Limacia cuspidata, *Hk. f. & Th.* 12.
Niri-wel, S.
32. Cocculus macrocarpus, *W. & A.* 13.
33. Stephania hernandifolia, *Walp.* 13.
Lunu-ketiya-wel, S.
34. Cissampelos Pareira, *L.* 13.
Diya-mitta, S.
var. subpeltata, *Thw.* 399.
35. Cyclea Burmanni, *Miers.* 13.
Kehi-pittan, *Kesi-pissan*, S.
[C. peltata, *Hk. f. & Th.*] 13.
36. Pachygone ovata, *Miers.* 13.

6. Berberideæ.

37. Berberis aristata, *DC.* 13.

7. Nymphæaceæ.

38. Nymphæa Lotus, *L.* 14.
var. pubescens, *Hk. f. & Th.*
O'lu, S.
N. stellata, *Willd.* 14.
Mánel, S.
39. Nelumbium speciosum, *Willd.* 14.
Nelun, S. *Tamarai*, T.

8. Cruciferæ.

40. Nasturtium indicum, *DC.* 399.
* N. officinale, *L.* *Kakkutu-palá*, S. *Water-cress.*
41. Cardamine africana, *L.* 399.
C. subumbellata, *Hk.* *C. hirsuta.* 14.
* Brassica juncea, *Hk. f. & Th.* 399.
Aba, S.

9. Capparideæ.

42. Cleome monophylla, *L.* 14.
C. tenella, *L. f.*
C. aspera, *Koen.* 14.
[C. Burmanni, *W. & A.*]
C. viscosa, *L.* *Polanisia viscosa.* 14.
Wal-aba, S.
43. Gynandropsis pentaphylla, *DC.* 14.
Wéla, S.
44. Mærua arenaria, *Hk. f. & Th.* *M. oblongifolia.* 15.

45. Cratæva Roxburghii, *R. Br.* 14.
Lunu-warana, S. *Navala*, T.
46. Cadaba trifoliata, *W. & A.* 15.
C. indica, *Lam.* 15.
47. Capparis zeylanica, *L.* *C. brevispina.* 15.
[C. Heyneana, *Wall.*]
C. divaricata, *Lam.* *C. stylosa.* 15.
C. Moonii, *Wight.* 16.
C. Roxburghii, *DC.* 15.
C. grandis, *L. f.* 16.
C. pedunculosa, *Wall.* 16.
C. sepiaria, *L.* 16.
var. RETUSELLA, *Thw.* (sp.) 16.
C. floribunda, *Wight.* 399.
C. horrida, *L. f.* 15.
Welangiriya, S.
C. tenera, *Dalz.*, var. ZEYLANICA, *Hk. f. & Th.* *C. tetrasperma.* 15.

10. Violaceæ.

48. Viola Patrinii, *DC.* 20.
V. distans, *Wall.* *V. Wightiana*, var. *glabra.* 20.
V. serpens, *Wall.* *V. Wightiana*, var. *pubescens.* 20.
49. Ionidium suffruticosum, *Ging.* 20.
I. RAMOSISSIMUM, *Thw.* 21.
50. Alsodeia zeylanica, *Thw.* 21.
A. DECORA, *Trim. ms.* C. P. 4006.
A. VIRGATA, *Hk. f. & Th.* *Scyphellandra.* 21.

11. Bixineæ.

(Cochlospermum Gossypium, *DC.*) *Kini-hiriya*, *Ela-imbul*, S.
(Bixa Orellana, *L.*) 16. *Kaha*, S. *Annatto.*
51. Scolopia crenata, *Clos.* *S. chinensis.* 400.
var. acuminata, *Clos.* (sp.) 400.
var. crassipes, *Clos*, (sp.) 400.
Katu-kurundu, *Katukenda* S.
52. ERYTHROSPERMUM PHYTOLACCOIDES, *Gardn.* 18.
53. (Flacourtia inermis, *Roxb.*) *Lovi-lovi.*
F. Ramontchi, *L'Herit.* *F. sapida.* 17.
Uguressa, S.
(var. Cataphracta, *Roxb.* (sp.)) *Rata-uguressa*, S.

F. sepiaria, *Roxb.* 17.
54. ABERIA GARDNERI, *Clos.* 400.
Kẹt-ambilla, S.
55. TRICHADENIA ZEYLANICA, *Thw.* 19.
Titta-gas, *Tolol*, S.
56. HYDNOCARPUS VENENATA, *Gaertn.* *H. inebrians.* 18.
Makulu, S.
H. alpina, *Wight.* 19.
H. OCTANDRA, *Thw.* 19.

12. Pittosporaceæ.

57. Pittosporum tetraspermum, *W. & A.* 68.
P. nilghirense, *W. & A.?* C.P. 3994.
P. ZEYLANICUM, *Wight.* 68.
Kẹtiya, S.

13. Polygalaceæ.

58. Polygala arillata, *Ham.* 22.
P. javana, *DC.* 22.
P. leptalea, *DC.* 22.
P. GLAUCOIDES, *L.* *P. arvensis*, vars. b. & a. 400.
var. hirsutula, *Thw.* *P. elongata*, var. *hirsutula.* 22.
[P. elongata, *Klein.*]
P. chinensis, *L.* *P. arvensis*, var. c. 400.
P. rosmarinifolia, *W. & A.* *P. rosm.*, var. *puberula.* 22.
P. sibirica, *L.*, var. macrolophos, *Hassk.* *P. glomerata.* 400.
P. telephioides, *Willd.* 22.
59. SALOMONIA CILIATA, *DC.* *S. cordata.* 22.
S. oblongifolia, *DC.* 22.
60. Xanthophyllum flavescens, *Roxb.* *X. virens.* 400.

14. Caryophyllaceæ.

61. Cerastium indicum, *W. & A.* 24.
† C. vulgatum, *L.* var. glomeratum, *Thuill.* (sp.)
62. STELLARIA DRYMARIOIDES, *Thw.* 24.
* S. media, *With.* 24. *Chickweed.*
* Sagina procumbens, *L.*
* Spergula arvensis, *L.* *Spurrey.*
63. Drymaria cordata, *Willd.* 25.
64. Polycarpon Loeflingiæ, *B. & Hk. f.* *Harpalosia.* 25.
65. Polycarpæa corymbosa, *Lam.* 25.

15. Portulacaceæ.

66. Portulaca oleracea, *L.* 23.
Genda kola, S. *Purslane.*
[P. Wightiana, *Wall.*]
P. quadrifida, *L.* 23.
Hín-genda-kola, S.
P. tuberosa, *Roxb.* 401.
U'ru-genda, S.
P. suffruticosa, *Wight.* 24.

16. Tamariscineæ.

67. Tamarix gallica, *L.* 401. *Tamarisk.*
[T. ericoides, *Roxb.*]

17. Elatineæ.

68. Bergia ammanioides, *Roxb.* 23.
B. verticillata, *Willd.* 23.

18. Hypericaceæ.

69. Hypericum mysorense, *Heyne.* 48.
H. japonicum, *Thunb.* 48.
* H. humifusum, *L.*

19. Guttiferæ.

70. Garcinia Cambogia, *Desr.* 48.
Goraka, S. *Korukkai-puḷi*, T.
var. Papilla, *Wight.* (sp.)
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Maḍol, S.
G. Morella, *Desr.* 49.
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G. TERPNOPHYLLA, *Thw.* 49, 406.
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G. spicata, *Hk. f.* *Xanthochymus ovalifolius.* 49.
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var. acutifolia, *T. And.*

71. Calophyllum spectabile, *Willd.* *C. Moonii.* 52.
Domba-kína, S.
C. Burmanni, *Wight.* 52.
Guru-kína, S. *Chiru-punnai*, T.
C. Inophyllum, *L.* 51.
Domba, S. *Punnai*, T.

C. tomentosum, *Wight.* 51.
Kína, S.
var. elatum, *Bedd.*, (sp.) (C. angustifolium, *Roxb.?*)
Tombu-kata, T.
C. BRACTEATUM, *Thw.* 51.
Walu-kína, S.
C. TRAPEZIFOLIUM, *Thw.* 51.
C. THWAITESII, *Pl. & Tri.* 407.
C. CORDATO-OBLONGUM, *Thw.* 407.
C. CUNEIFOLIUM, *Thw.* 51.
C. WALKERI, *Wight.* 51.
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72. KAYEA STYLOSA, *Thw.* 50.
Suwanda, S.
73. Mesua ferrea, *L.* 50.
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var. sclerophylla, *Thw.* (sp.) 407.
var. pulchella, *Pl. & Tri.* (sp.) 407.
M. THWAITESII, *Pl. & Tri.* 407.
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20. Ternstrœmiaceæ.

74. Ternstrœmia japonica, *Thunb.* *Cleyera gymnanthera.* 40.
T. EMARGINATA, *Chois.* *Cleyera.* 40.
75. ADINANDRA LASIOPETALA, *Chois.* *Sarosanthera.* 41.
76. Eurya japonica, *Thunb.* 41.
Neya-dasse, S. *Wild Tea.*
var. chinensis, *R. Br.* (sp.) var. *parviflora.* 41.
var. ZEYLANICA, *Wight* (sp.) var. *chinensis.* 41.
E. acuminata, *DC.* *E. japonica*, var. *acuminata.* 41.
77. GORDONIA ZEYLANICA, *Wight.* 40.
G. ELLIPTICA, *Gardn.*
G. SPECIOSA, *Thw.* 40.

21. Dipterocarpaceæ.

78. DIPTEROCARPUS HISPIDUS, *Thw.* Includes *D. oblongifolius.* 33.
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D. ZEYLANICUS, *Thw.* 33.
Hora, S.
D. GLANDULOSUS, *Thw.* 34.
Dorana, S.

D. SCABRIDUS, *Thw.* 34.

D. INSIGNIS, *Thw.* 34.

79. SUNAPTEA SCABRIUSCULA, *Trim.* *Vateria (Stemonoporus.)* 404.

S. ? DISTICHA, *Trim.* *Vateria (Stemonoporus.)* 404.

80. Vatica Roxburghiana, *Bl.* (V. chinensis, *L.*) 404, 37.
Mendóra, S.

V. AFFINIS, *Thw.* 404.

V. OBSCURA, *Trim. ms.*
Tumpalai, T.

V. ? CORDIFOLIA, *Thw.* 404.

81. SHOREA OBLONGIFOLIA, *Thw.* 36.

S. DYERII, *Thw. ms.* C.P. 4010.

S. LISSOPHYLLA, *Thw.* 402.

S. STIPULARIS, *Thw.* 36.
var. minor, *Thw. ms.* C.P. 3987 (part) & 4024.

S. RETICULATA, *Thw. (in Fl. Brit. Ind.)* C.P. 3884.

S. BREVIPETIOLARIS, *Thw. ms.* C.P. 4008.

82. HOPEA DISCOLOR, *Thw.* 36.

H. JUCUNDA, *Thw.* 403.
var. modesta, *A. DC.*

83. DOONA ZEYLANICA, *Thw.* 34.
Dún, S.

D. NERVOSA, *Thw.* 35.

D. AFFINIS, *Thw.* 35.

D. TRAPEZIFOLIA, *Thw.* 35.
Yaka-halu, S.

D. CONGESTIFLORA, *Thw.* 35.
Tiniya, S.

D. OBLONGA, *Thw. ms.* C.P. 3986.

D. GARDNERI, *Thw.* 35.

D. CORDIFOLIA, *Thw.* 35.
Beraliya, S.

D. MACROPHYLLA, *Thw.* 402 & C.P. 3987 (part).
Honda-beraliya, S.

D. OVALIFOLIA, *Thw.* 402.

D. VENULOSA, *Thw.* 402.

84. VATERIA ACUMINATA, *Hayne.* *V. indica.* 37.
Hal, S. *Pinai*, T.

V. (STEMONOPORUS) ZEYLANICA, *Wight.* *V. Wightii.* 37, 403.

V. (S.) GARDNERI, *Thw.* 403.

V. (S.) JUCUNDA, *Thw. (in Fl. Brit. Ind.)* *V. acuminata.* 403.
V. (S.) AFFINIS, *Thw.* 403.
V. (S.) LANCEOLATA, *Thw.* 403.
V. (S.) CANALICULATA, *Thw.* 403.
V. (S.) PETIOLARIS, *Thw.* 403.
V. (S.) RIGIDA, *Thw.* 403.
V. (S.) OBLONGIFOLIA, *Thw.* 403.
V. (S.) RETICULATA, *Thw.* 403.
V. (S.) NITIDA, *Thw.* 403.
var. lancifolia, *Dyer.* *V. lancifolia.* 404.
V. (S. ?) NERVOSA, *Thw. ms.* C.P. 3885.
V. (S.) MOONII, *Thw.* 403.
85. MONOPORANDRA CORDIFOLIA, *Thw.* 39. *Vateria.* 404.
M. ELEGANS, *Thw.* 39. *Vateria.* 404.

21 bis. Ancistrocladeæ.

86. ANCISTROCLADUS VAHLII, *Arn.* 188.
Góna-wẹl, S.

22. Malvaceæ.

* Malvastrum carpinifolium, *A. Gr.* 441.
87. Sida humilis, *Willd.* 28.
Bẹvila, S.
S. mysorensis, *W. & A.* 28.
S. spinosa, *L.* *S. alba.* 28.
S. carpinifolia, *L.* *S. acuta.* 27.
S. rhombifolia, *L.* *S. retusa.* 28.
Koṭikan-bẹvila, S.
var. rhomboidea. *S. rhombifolia.* 28.
S. cordifolia, *L.* 28.
† Wissadula zeylanica, *Medik.* *W. periplocifolia.* 27.
Kiri-kaju, S.
(W. Leschenaultiana, *Mast.*) *Abutilon*, 401.
88. † Abutilon polyandrum, *W. & A.* 27.
A. asiaticum, *D. Don.* 27.
Anóddá, S.
A. indicum, *G. Don.* 27.
Perun-tutti, T.
A. graveolens, *W. & A.* 27.
A. muticum, *G. Don.* *A. tomentosum.* 27.
A. crispum, *G. Don.* 401.

89. Urena lobata, *L.* 25.
Paṭṭá-ẹpala, S.
U. sinuata, *L.* 25.
Hín-ẹpala, S.
90. Pavonia glechomifolia, *A. Rich.*
P. zeylanica, *Cav.* 26.
P. odorata, *Willd.* 26.
91. JULOSTYLIS ANGUSTIFOLIA, *Thw.* 30.
92. DICELLOSTYLES AXILLARIS, *Benth.* 401.
93. Hibiscus surattensis, *L.* 26.
Hín-nápiritta, S.
H. furcatus, *Roxb.* 26.
Nápiritta, S.
H. micranthus, *L.* 26.
Pir-amati, T.
H. Solandra, *L'Herit.* *Lagunea lobata.* 27.
H. collinus, *Roxb.* *H. eriocarpus.* 26.
Paritti, T.
H. lunariifolius, *Willd.* 401.
H. panduræfolius, *Burm.* 26.
H. vitifolius, *L.* 26.
H. cannabinus, *L.* 401.
(H. Sabdariffa, *L.*) *Rozelle.*
H. ficulneus, *L.* *Abelmoschus.* 27.
H. angulosus, *Mast.* *Abelmoschus.* 26.
Kapu-kinissa, S.
var. grandiflorus, *Thw.*
var. purpureus, *Thw.*
H. Abelmoschus, *L.* *Abelmoschus moschatus.* 27.
(H. esculentus, *L.*) *Bandakai*, T.
H. tiliaceus, *L.* *Paritium.* 26.
Beli-paṭṭá, S.
94. Thespesia Lampas, *Dalz. & Gibs.* *Hibiscus.* 26.
T. populnea, *Corr.* 27.
Súriya, S. *Pu-varasu*, T. *Tulip tree.*
(Adansonia digitata, *L.*) *Paparu-pulli*, T. *Baobab.*
95. Bombax malabaricum, *DC.* *Salmalia.* 28.
Kaṭu-imbul, S. *Parutti*, T. *Red Cotton tree.*
96. Eriodendron anfractuosum, *DC.* *E. orientale.* 28.
Imbul, S. *Elavum*, *Illaku*, T. *White Cotton tree.*
97. Cullenia excelsa, *Wight.* 28.
Kaṭu-boda, S. *Konji*, T. *Wild Durian.*

23. Sterculiaceæ.

98. Sterculia fœtida, *L.* 29.
Telambu, S. *Kaditeni, Pinari*, T.
S. urens, *Roxb.* 29.
Kavali, T.
S. guttata, *Roxb.* 29.
S. Balanghas, *L.* 29.
Nává, S.
S. colorata, *Roxb.* *Firmiana.* 29.
S. Thwaitesii, *Mast.* *Pterygota alata* 29.
99. Heritiera littoralis, *Dryand.* 28.
Ẹtuna, S.
100. Helicteres Isora, *L.* 28.
Líniya, S. *Vullum-puri*, T.
101. Pterospermum suberifolium, *Lam.* 30.
Velanga, S. *Toddi, Vinnaku*, T.
102. Melochia corchorifolia, *L.* 30.
103. Waltheria indica, *L.* 30.
* Guazuma tomentosa, *Kunth.* 29.
Patti-parutti, T.

24. Tiliaceæ.

104. Pityranthe verrucosa, *Thw.* 29.
105. Berrya Ammonilla, *Roxb.* 32.
Hal-milla, S. *Chamandalé, Malé,Kada-manakku* T.
Trincomalee Wood.
106. Grewia columnaris, *Sm.* 31.
Koddi-thuvattai, T.
* G. orientalis, *L.* 31.
Thuvattai, T.
G. populifolia, *Vahl.*
G. orbiculata, *Rottl.* *G. rotundifolia.* 402.
G. tiliæfolia, *Vahl.* 32.
Daminiya, S. *Chadachi*, T.
(G. asiatica, *L.*)
G. bracteata, *Roth.*
G. diplocarpa, *Thw.* 31.
G hirsuta, *Vahl.* 31.
G. polygama, *Roxb.* *G. helicterifolia.* 31.
G. Microcos, *L.* 32.
Ḳeliya, S.
107. Triumfetta tomentosa, *Boj.* *T. pilosa*, var. *a.* 31.

T. pilosa, *Roth.* *T. pilosa*, var. *β.* 31.
T. rhomboidea, *Jacq.* *T. angulata.* 31.
Ẹpala, S.
T. CONSPICUA *Trim. ms.*
T. neglecta, *W. & A.* *T. pilosula.* 401.
108. Corchorus capsularis, *L.* 31.
C. olitorius, *L.* 31.
C. urticæfolius, *W. & A.* 31.
C. fascicularis, *Lam.* 401.
C. tridens, *L.* 401.
C. acutangulus, *Lam.* 31.
109. Elæocarpus serratus, *L.* 32.
var. cuneatus, *Wight, (sp.)*
Weralu, S. *Wild Olive.*
[E. robustus, *Roxb.*]
E. amœnus, *Thw.* 32 & C.P. 3906.
E. OBOVATUS, *Arn.* 32.
E. MONTANUS, *Thw.* 32.
E. SUBVILLOSUS, *Arn.* 33.
Gal-weralu, S.
E. ZEYLANICUS, *Arn.* *Monocera Walkeri.* 33.
E. GLANDULIFER, *Mast.* *Monocera.* 33.

25. Linaceæ.

110. Linum mysorense, *Heyne.* 25.
111. Hugonia Mystax, *L.* 25.
Maha- or *Bú-geṭiya*, S. *Morthiré-kuma*, T.
H. FERRUGINEA, *W. & A.* 25.
112. Erythroxylum monogynum, *Roxb.* *Sethia indica.* 53.
Tevaturam, T.
E. lanceolatum, *Hk. f.* *Sethia.* 54.
E. LUCIDUM, *Moon.* *Sethia acuminata.* 54.
Baṭa-kirilla, S. *Siru-chenumutthi*, T.
var. minor. C. P. 4011.
E. OBTUSIFOLIUM, *Hk. f.* *Sethia.*

26. Malpighiaceæ.

113. Hiptage Madablota, *Gaertn.* 53.
Puwak-geḍiya-wẹl, S.
H. parviflora, *W. & A.* 53.

27. Zygophyllaceæ.

114. Tribulus terrestris, *L.* 68.
Sembu-nerenchi, S. & T.

28. Geraniaceæ.

115. Geranium nepalense, *Sweet.* 64.
116. Oxalis corniculata, *L.*
Hín-ẹmbul-ẹmbiliya, S.
* O. purpurata, *Jacq.*
117. Biophytum sensitivum, *DC. Oxalis.* 409.
var. nervifolia, *Edgew.* & *Hk. f.*
Gas-nidi-kumba, S.
B. Reinwardtii, *Walp.*
B. NUDUM, *Arn.* *Oxalis sensitiva*, var. *β.* 409.
B. PROLIFERUM, *Arn.* *O. sensitiva*, var. *γ.* 409.
? B. intermedium, *Wight.*
(Averrhoa Bilimbi, *L.*) *Bilin*, S. *Blimbing.*
(A. Carambola, *L.*) *Kámaranga*, S.
118. Impatiens acaulis, *Arn.* 68.
I. oppositifolia, *L.* *I. rosmarinifolia.* 65.
I. cuspidata, *W.* & *A.* 65.
var. bipartita, *Arn.* (sp.)
I. Balsamina, *L.* 65.
I. GLANDULIFERA, *Arn.* 66.
I. MACROPHYLLA, *Gardn.* 66.
I. REPENS, *Moon.* 66.
Gal-demaṭa, S.
I. LEPTOPODA, *Arn.* 65.
I. TRUNCATA, *Thw.* 66.
I. flaccida, *Arn.* 65.
Kúḍalu-mal, S.
I. Henslowiana, *Arn.* 65.
I. JANTHINA, *Thw.* 68.
I. SUBCORDATA, *Arn.* 67.
I. HOOKERIANA, *Arn.* 66.
I. LEUCANTHA, *Thw.* 67.
I. LINEARIS, *Arn.* 67.
I. APPENDICULATA, *Arn.* 67.
I. ELONGATA, *Arn.* 67.
I. CORNIGERA, *Arn.* 67.
I. ARNOTTII, *Thw.* 67.
I. WALKERI, *Hook.* 66.
119. Hydrocera triflora, *W.* & *A.* 68.
Diya-kúḍalu, S.

29. Rutaceæ.

120. Evodia Roxburghiana, *Benth.* *E. triphylla.* 409.
Lunu-ankenda, S.

121. Zanthoxylum tetraspermum, *W. & A.* 69.
(Z. Rhetsa, *DC.*) 69.
Kaṭu-kína, S.

122. Toddalia aculeata, *Pers.* 69.
Kuḍu-miris, S.

123. Acronychia laurifolia, *Bl.* *A. pedunculata.* 409.
Ankenda, S.

124. Glycosmis pentaphylla, *Corr.* Includes *G. arborea.* 45.
var. longifolia, *Oliv.*
Dodan-paná, S. *Kulla-pannai*, T.
G. BILOCULARIS, *Thw.* 45.

125. Micromelum pubescens, *Bl.* 46.
Wal-karapincha, S.

126. Murraya exotica, *L.* 45.
Eṭṭériya, S.
(var. buxifolia, *Thw.*)
var. paniculata, *Thw.*
M. GLENIEI, *Thw.* 406.
M. Koenigii, *Spreng.* 406.
Karapincha, S. *Kurrivuppu*, T. *Curry-leaf.*

127. Clausena indica, *Oliv.* 406.
Mígoṇ-karapincha, S. *Purunké-nurai*, T.
C. Willdenovii, *W. & A.* 47.
var. pubescens, *Thw.* 407.

128. Limonia alata, *W. & A.* 45.
Tumpat-kurundu, S.

129. Luvunga eleutherandra, *Dalz.* 48, 406.

130. Paramignya monophylla, *Wight.* 47.
Wellangiriya, S.
P. ARMATA, *Oliv.* 406.

131. Atalantia monophylla, *DC.* 44.
Perum-kurundu, T.
A. racemosa, *W. & A.* 405.
A. zeylanica, *Oliv.* 405.
Yakinárán, S. *Né-kurundu*, T.
var. rotundifolia, *Oliv.*
A. Missionis, *Oliv.* 405.
Pamburu, S. *Kurundu*, T.

132. Feronia elephantum, *Corr.* 48.
Diwul, S. *Mèladi-kurundu*, T. *Wood Apple.*
(Ægle Marmelos, *Corr.*) *Beli*, S. *Vila, Vilva*, T. *Bael.*

30. Simarubaceæ.

133. Ailantus malabarica, *DC.* 69.
Kumbalu, Wal-bilin, S.
134. Samadera indica, *Gaertn.* 70.
Samadará, S.
* Brucea sumatrana, *Roxb.* 69.

31. Ochnaceæ.

135. Ochna squarrosa, *L.* Includes *O. rufescens.* 70.
Mal-kẹra, S.
var. cordata, *Thw.* 409.
O. Wightiana, *Wall.* Includes *O. Moonii.* 70.
136. Gomphia angustifolia, *Vahl.* 71.
Bó-kẹra, S.

32. Burseraceæ.

(Boswellia serrata, *Roxb.*) C. P. 3878.
137. Balsamodendrum caudatum, *March.* *Protium.* 78.
Kilivai, T.
B. Berryi, *W. & A.* ?
Mul-kilivai, T.
138. Canarium brunneum, *Bedd.* *Scutinanthe.* 78.
Maha-bulu-mora, S.
C. zeylanicum, *Bl.* 79.
Kẹkuna, S.
139. Filicium decipiens, *Thw.* 408.
Pehimbiya, S.

33. Meliaceæ.

140. Munronia pumila, *Wight.* 59.
Bin-kohomba, S.
141. Azadirachta indica, *A Juss.* 59.
Kohomba, S. *Vempu*, *T.*
142. (Melia Azedarach, *L.*) *Bead tree.* *Indian Lilac.*
M. dubia, *Cav.* *M. composita.* 59.
Lunu-midẹlla, S. *Malai-vempu, Patiri*, T.
143. Cipadessa fruticosa, *Bl.* *Mallea Rothii.* 60.
Hál-bẹmbiya, S.
144. Dysoxylum binectariferum, *Hk. f.* *D. macrocarpum.* 60.

145. (Aglaia odorata, *Lour.*)
A. APIOCARPA, *Hiern.* *Milnea.* 60.
A. Roxburghiana, *Miq.* *Milnea.* 60.
146. Amoora Rohituka, *W. & A.* 60.
Hingul, S.
147. PSEUDOCARAPA CHAMPIONII, *Hemsl.* *Amoora.* 409.
148. WALSURA GARDNERI, *Thw.* 61.
W. Piscidia, *Roxb.* 61.
Kiri-kón, S. *Chadda-vakku, Walsurai, Kanná-kampu*, T.
149. Carapa moluccensis, *Lam.* *Xylocarpus Granatum.* 61.
(Soymida febrifuga, *A. Juss.*)
150. Chickrassia tabularis, *A. Juss.* 61.
Hulan-hik, S. *Aglai, Kulothi*, T.
151. Chloroxylon Swietenia, *DC.* 61.
Buruta, S. *Mutirai*, T. *Satinwood.*

34. Chailletiaceæ.

152. Chailletia gelonioides, *Hk. f.* *Moacurra.* 79.
Balu-nakuta, S.

35. Olacineæ.

153. Ximenia americana, *Willd.* C.P. 2332.
154. Olax scandens, *Roxb.* 42.
O. Wightiana, *Wall.* 42.
O. ZEYLANICA, *L.* 42.
Mella, S.
155. Strombosia zeylanica, *Gardn.* *S. javanica.* 42.
156. Cansjera Rheedei, *Gmel.* 251.
157. Opilia amentacea, *Roxb.* 41.
158. Lasianthera apicalis, *Thw.* 405.
Urukanu, S.
159. Gomphandra axillaris, *Wall.* *Platea.* 44.
G. polymorpha, *Wight.* *Platea coriacea.* 44.
160. APODYTES GARDNERIANA, *Miers.* 42.
161. Mappia ovata, *Miers.* *M. fœtida.* 43.
var. Championiana, *Miers.* (sp.)
Gandapána, S.
162. Pyrenacantha volubilis, *Hook.* 290.

36. Ilicineæ.

163. Ilex Walkeri, *Wight & Gardn.* 184.
I. denticulata, *Wall.* 183.

I. Wightiana, *Wall.* 183.
Andun-wenna, S.

37. Celastraceæ.

164. Euonymus revolutus, *Wight.* 73.
E. Thwaitesii, *Laws.* *E. dichotomus.* 73.
E. Walkeri, *Wight.* 73.
? E. dichotomus, *Heyne.*
165. Glyptopetalum zeylanicum, *Thw.* 73.
166. Microtropis Wallichiana, *Wight.* 71.
M. ramiflora, *Wight.* 72.
167. Kokoona zeylanica, *Thw.* 52.
Wana-potu, Kokun-potu, S.
168. Pleurostylia Wightii, *Thw.* 71.
Piyari, S.
169. Celastrus paniculata, *Willd.* 72.
Duhudu, S.
170. Gymnosporia fruticosa, *Hk. f.* 409.
G. emarginata, *Roth.* 409.
171. Kurrimia zeylanica, *Arn.* 72.
Pelan, Hurukandu, Et-heraliya, S. *Konnai*, T.
172. Elæodendrum glaucum, *Pers.* 73.
var. montanum, *Thw.*
Neralu, S. *Pieri, & (with serrate leaves) Karukku-váchchi*, T.
173. Hippocratea obtusifolia, *Roxb.* 52.
Diya-kirindi-wel, S.
H. Arnottiana, *Wight.* *Salacia terminalis.* 407.
H. indica, *Willd.* 52.
174. Salacia prinoides, *DC.* 53.
Hín-himbutu-wel, S.
S. reticulata, *Wight.* 53.
var. diandra, *Laws.* *S. diandra.* 53.
Himbutu-wel, S.
S. oblonga, *Wall.* 53.

38. Rhamnaceæ.

175. Ventilago maderaspatana, *Gaertn.* 74.
Vaimbadam, T.
176. Zizyphus Jujuba, *Lam.* 74.
Maha-debara, Masan, S. *Ilanthai*, T.
Z. Œnoplia, *Mill.* 74.
Hín-eraminiyá, S. *Churai*, T.

Z. xylopyra, *Willd.* 74.
Nani-ilanthai, T.
Z. Napeca, *Willd.*
var. lucida, *Moon* (sp.) (Z. Linnæi, *Laws.* ?) 74.
Z. rugosa, *Lam.* 73.
Maha-eramiṇiyá, S. *Churai*, T.
177. Rhamnus Arnottianus, *Gardn.* 74.
R. Wightii, *W. & A.* 74.
178. Scutia indica, *Brongn.* 75.
179. Sageretia costata, *Miq.* *S. affinis.* 410 (C.P. 2477).
180. Colubrina asiatica, *Brongn.* 75.
Tel-híriya, S.
181. Gouania microcarpa, *DC.* 75.

39. Ampelideæ.

182. Vitis quadrangularis, *Wall.* *Cissus edulis.* 62.
Híreṣsa, S.
V. glyptocarpa, *Laws.* *Cissus.* 62.
V. lonchiphylla, *Laws.* *Cissus.* 62.
V. pallida, *W. & A.?* *Cissus glauca.* 62.
V. repanda, *W. & A.* *Cissus acuminata & C. repens*, 62 & C.P. 3962.
V. adnata, *Wall.* *Cissus.* 62.
Wal-diya-labu, S.
V. Linnæi, *Wall.* *Cissus angulata.* 62.
Kaddu-montherai, T.
V. tomentosa, *Heyne.*
V. erioclada, *W. & A.* *V. indica.* 63.
To-weḷ, *Riṭa-bulat-weḷ*, S.
V. Rheedii, *W. & A.* *Cissus trilobata.* 62.
V. setosa, *Wall.* *Cissus.* 63.
V. carnosa, *Wall.* *Cissus.* 63.
Wal-rat-diya-labu, S.
V. reticulata, *Laws.* *Cissus.* 63.
V. Gardneri, *Laws.* *Cissus.* 63.
V. lanceolaria, *Wall.* Includes *Cissus muricata.* 63.
V. pedata, *Vahl.* *Cissus.* 63.
Meḍiya-weḷ, S.
183. Leea sambucina, *Willd.* *L. Staphylea.* 64.
Burulla, *Gurulla*, S.

40. Sapindaceæ.

184. Cardiospermum Halicacabum, *L.* 54.
Penela-weḷ, S.

C. canescens, *Wall.*
185. Hemigyrosa canescens, *Thw.* 56.
var. trichocarpa, *Thw.* (sp.) 56.
(Dittelasma Rarak, *Hk. f.*)
186. Allophylus zeylanicus, *L.* *Schmidelia allophylla.* 55.
var. ACUMINATA, *Hiern.* *Schmidelia.* 55.
var. varians, *Hiern.* *Schmidelia.* 408.
var. THWAITESII, *Hiern.*
A. HISPIDA. *Schmidelia.* 55.
A. Cobbe, *Bl.* *Schmidelia.* 55.
var. villosa, *Hiern.* *Schmidelia.* 55.
Kobbę, S.
187. Schleichera trijuga, *Willd.* 58.
Kón, S. *Puvu, Kúḷá,* T. *Ceylon Oak.*
188. GLENIEA ZEYLANICA, *Hk. f.* 408.
var. unijuga, *Thw.* 408, 56.
var. fuscata, *Thw.* 408, 58.
189. Sapindus laurifolius, *Vahl.* 55.
Kaha-penela, S.
S. emarginatus, *Vahl.* 55.
Penela, S. *Púvanti,* T.
S. ERECTUS, *Hiern.* *Nephelium.* 57.
S. THWAITESII, *Hiern.* *Nephelium simplicifolium.* 57.
S. bifoliatus, *Hiern.* *Nephelium.* 57.
190. Nephelium Longana, *Camb.* 58.
Mora, S. *Moreli,* T.
N. GARDNERI, *Thw.* 58.
191. Pometia eximia, *Hk. f.* 408.
Gal-mora, S. (Kandyan country.)
192. Harpullia cupanioides, *Roxb.* *H. imbricata.* 56.
Ná-imbul, S.
193. Dodonæa viscosa, *L.* *D. Burmanniana.* 59.
Ẹta-wẹrẹlla, S. *Virali,* T.
194. Turpinia pomifera, *DC.* *T. nepalensis.* 71.
Ẹta-kirilla, Kaṇkumbalá, S.

41. Sabiaceæ.

195. Meliosma Wightii, *Planch.* *M. pungens.* 59.
M. simplicifolia, *Walp.* 59.
Ẹlbẹdda, S.
M. Arnottiana, *Wight.* 59.

42. Anacardiaceæ.

(Mangifera indica, *L.*) *Mango.*

196. M. ZEYLANICA, *Hk. f.* *M. indica.* 75.
Amba, Wal-amba, S. *Ma, Káddu Má,* T. *Wild Mango.*

(Anacardium occidentale, *L.*) *Kaju,* S. *Cashew-nut.*

197. Buchanania angustifolia, *Roxb.* 78.

198. Odina Woodier, *Roxb.* 78.
Hik, S. *Othi,* T.

199. SEMECARPUS PUBESCENS, *Thw.* 77.
S. THWAITESII, *Hk. f.* C. P. 3886.
S. MARGINATA, *Thw.* 77.
S. OBOVATA, *Moon.* 77.
S. MOONII, *Thw.* 77.
S. CORIACEA, *Thw.* 77.
S. SUBPELTATA, *Thw.* 75.
Maha-badulla, S.
S. GARDNERI, *Thw.* 76.
Badulla, S.
S. WALKERI, *Hk. f.* *S. obscura* (in part). 410.
S. OBSCURA, *Thw.* Includes *S. oblongifolia, α.* 76, 410.
S. ACUMINATA, *Thw.* *S. oblongifolia, γ.* 76, 410.
S. NIGRO-VIRIDIS, *Thw.* *S. oblongifolia, β.* 76, 410.
S. PARVIFOLIA, *Thw.*
Hín-badulla, S.
S. LÆVIGATA, *Thw. (in Fl. Brit. Ind.)* C. P. 3948.

200. Nothopegia Colebrookiana, *Bl.* 441.
Bala, S.

201. CAMPNOSPERMA ZEYLANICUM, *Thw.* 78.
Aridda, S.

202. Spondias mangifera, *Willd.* *Evia amara.* 78.
Embarella, S. *Ampallai,* T. *Hog-Plum.*

(Moringeæ.)

(Moringa pterygosperma, *Gaertn.*)
Murungá, S. *Murunkai,* T. *Horse-radish Tree.*

POLYPETALÆ CALYCIFLORÆ.

43. Connaraceæ.

203. Rourea santaloides, *W. & A.* 80.
Kirindi-wel, S.

204. Connarus monocarpus, *L.* 80.
Radaliya, S.
C. CHAMPIONII, *Thw.* 80.
Wel-radaliya, S.
205. ELLIPANTHUS THWAITESII, *Hk. f.* 410.

44. Leguminosæ.

206. Rothia trifoliata, *Pers.* 82.
207. Heylandia latebrosa, *DC.* 81.
208. Crotalaria biflora, *L.* 81. Includes *C. globosa.* 410.
C. prostrata, *Roxb.* 81.
C. ferruginea, *Grah.* 81.
C. evolvuloides, *Wight.* 81.
[C. bifaria, *L.*]
C. MULTIFLORA, *Benth.* 81.
C. rubiginosa, *Willd.* C. *Wightiana.* 81.
C. mysorensis, *Roth.* 82.
C. triquetra, *Dalz.* 410.
C. albida, *Heyne.* 82.
C. nana, *Burm.* Includes *C. umbellata.* 82.
C. linifolia, *L. f.* 82.
C. calycina, *Schrank.* 82.
C. retusa, *L.* 81.
Kaha-andana-hiriya, S.
var. maritima, *Trim.*
C. verrucosa, *L.* 81.
Nil-andana-hiriya, S.
C. semperflorens, *Vent.*, var. *Walkeri*, Arn. (sp.) 81.
C. juncea, *L.*
Hana, S. *San* or *Sunn Hemp.*
(C. fulva, *Roxb.*)
C. lunulata, *Heyne.* 81.
C. medicaginea, *Lam.* 82.
* C. Willdenowiana, *DC.* 441.
* C. incana, *L.* 82.
C. striata, *DC.* 82.
var. acutifolia, *Trim.* 410.
C. laburnifolia, *L.* 82.
Yakbériya, S.
C. quinquefolia, *L.* 82.
* Trifolium repens, *L.* 82.
* T. minus, *Sm.*
209. Parochetus communis, *Ham.* 82.

210. Indigofera echinata, *Willd.* *Acanthonotus.* 83.
I. linifolia, *Retz.* 83.
I. enneaphylla, *L.* 83.
I. aspalathoides, *Vahl.* 83.
Chivanár-vémbu, T.
I. pentaphylla, *L.* 411.
I. tenuifolia, *Rottl.* 83.
I. viscosa, *Lam.* 83.
I. trifoliata, *L.* 83.
I. trita, *L. f.* 83.
I. subulata, *Vahl.* *I. flaccida.* 83.
I. paucifolia, *Del.* 83.
I. hirsuta, *Del.* 83.
* I. tinctoria, *L.* 411.
Nil-awari, S. *Indigo.*
I. constricta, *Trim. ms.* *I. flaccida,* var. *constricta.* 411.
I. Wightii, *Grah.* *I. inamœna.* 83.
I. galegoides, *DC.* 83.
211. Psoralea corylifolia, *L.* 84.
212. Mundulea suberosa, *Benth.* *Tephrosia.* 84.
213. Tephrosia tinctoria, *Pers.* 84.
Alu-pila, S.
var. intermedia, *W. & A.*
var. pulcherrima, *Wight.*
T. spinosa, *Pers.* 411.
[T. senticosa, *Pers.*]
T. purpurea, *Pers.* 84.
Pila, S.
var. maxima, *Baker.* *T. maxima.* 84.
T. Hookeriana, *W. & A.* *T. hirta.* 84 (C. P. 2776.)
T. villosa, *Pers.* 84.
Bú-pila, S.
var. argentea, *Thw.*
214. Sesbania ægyptiaca, *Pers.* 84.
Karum-chembai, T.
S. aculeata, *Pers.*
var. SERICEA, *Benth.* 441.
(S. grandiflora, *Pers.*) *Akatti*, T. *Katuru-murungá*, S.
[Geissaspis cristata, *W. & A.*]
215. Zornia diphylla, *Pers.*
var. zeylonensis, *Baker.* *Z. angustifolia & Z. conjugata.* 84, 85.

var. Walkeri, *Arn.* (sp.) 85.

216. Stylosanthes mucronata *Willd.* 84.
Wel-nánu, S.

217. Smithia sensitiva, *Ait.* C. P. 3946.
S. geminiflora, *Roth*, var. conferta, *Baker.* *S. conferta.* 85.
S. blanda, *Wall.* 85.
var. racemosa, *Baker.*

218. Æschynomene indica, *L.* 85.
Diya-siyambalá, S.
Æ. aspera, *L.* 85.
Maha-diya-siyambalá, S. *Attunetta*, T.

219. Ormocarpum sennoides, *DC.* 85.

220. Eleiotis sororia, *DC.* 412.

221. Pycnospora hedysaroides, *R. Br.* *P. nervosa,* 92.

222. Pseudarthria viscida, *W. & A.* 87.

223. Uraria picta, *Desv.* 85.
(U. crinita, *Desv.*) 85.
U. hamosa, *Wall.* 85.

224. Alyssicarpus monilifer, *DC.* 412.
A. vaginalis, *DC.* 87.
A. bupleurifolius, *DC.* 87.
Aswenna, S.
A. longifolius, *W. & A.* 412.
A. rugosus, *DC.* *A. Heyneanus,* 88.
var. styracifolius, *W. & A.* (sp.) *A. scariosus.* 88.

225. Desmodium umbellatum, *DC.* *Dendrolobium,* 86.
D. cephalotes, *Wall.* *Dendrolobium,* 86.
D. pulchellum, *Benth.* *Phyllodium.* 86.
Hampinna, S.
D. biarticulatum, *Benth.* *Dicerma.* 86.
D. laburnifolium, *DC.* *Catenaria.* 86.
D. triquetrum, *DC.* *Pteroloma.* 86.
Báloliyá, S.
D. ormocarpoides, *DC.* 87, 441.
D. Gardneri, *Benth.* *D. podocarpum.* 87.
D. Scalpe, *DC.* *D. strangulatum.* 87.
D. gangeticum, *DC.* 411.
D. latifolium, *DC.* 87.
* D. cajanæfolium, *DC.* Includes *Hedysarum mucronatum.* 87, 411.
D. Thwaitesii, *Baker.* *D. strangulatum,* var. *minor.* 87.

D. Wightii, *Grah.* 87.
D. rufescens, *DC.* *D. ferrugineum.* 87.
D. polycarpum, *DC.* 86.
var. *trichocaulon, DC.* (sp.)
D. JUCUNDUM, *Thw.* 411.
D. triflorum, *DC.* 86.
Hin-undu-piyali, S.
D. heterophyllum, *DC.* 86.
Maha-undu-piyali, S.
D. parvifolium, *DC.* 86.
D. gyrans, *DC.* 87.
Chanchala, S. *Telegraph Plant.*
D. gyroides, *DC.* 87.
226. Abrus precatorius, *L.* 91.
Olinda-weḷ, S. *Kundumani*, T.
A. pulchellus, *Wall.* 91.
227. Shuteria vestita, *W. & A.* 88.
228. Dumasia villosa, *DC.*, var. leiocarpa, *Benth.* 88
229. Glycine javanica, *L.* *Soja Wightii.* 88.
230. Teramnus labialis, *Spreng.* *Glycine.* 88.
231. Mucuna monosperma, *DC.* 89.
M. atropurpurea, *DC.* 89.
M. gigantea, *DC.* 89.
M. pruriens, *DC.* *M. prurita.* 89.
var. biflora.
Achâriyâ-palu, S. *Cowitch.*
232. Erythrina indica, *L.* 89.
Erabadu, S. *Murukku*, T.
E. ovalifolia, *Roxb.* 89.
Yak-erabadu, S.
[E. suberosa, *Roxb.*]
233. Strongylodon ruber, *Vog.* 89.
234. Galactia tenuiflora, *W. & A.* 88.
235. Spatholobus Roxburghii, *Benth.* ("Walker, 1331.")
236. Butea frondosa, *Roxb.* 89.
Gas-kẹla, S.
237. † Canavalia ensiformis, *DC.* *C. gladiata.* 88.
Wal-awara, S.
var. virosa, *Baker.* *C. virosa.* 89.
C. obtusifolia, *DC.* 88.
238. Dioclea reflexa, *Hk. f.* *D. Fergusonii.* 412.

239. Phaseolus adenanthus, *G. F. Mey.* *P. truxillensis.* 89
Wal-mé, S.
P. Grahamianus, *W. & A.* 90.
P. semierectus, *L.* 90.
P. trilobus, *Ait.* 90.
Bin-mé, S.
P aconitifolius, *Jacq.*
† P. Mungo, *L.*
Mun-eta, S. *Green Gram.*
var. radiatus, *L.* (sp.) 89.
P. trinervius, *L.* 90.
P. calcaratus, *Roxb.* 412.
240. Vigna luteola, *Benth.* 90.
(V. Catiang, *Endl.*)
V. vexillata, *Benth.* 90.
* Centrosæma Plumieri, *Benth.*
241. Clitoria Ternatea. *L.* 88.
Nil-katarolu, S.
242. Dolichos Lablab, *L.* *Lablab vulgaris.* 90.
D. biflorus, *L.* *D. uniflorus.* 90.
Kollu, S. & T. *Horse Gram, Madras Gram.*
D. ciliatus, *Klein.* 90.
D. falcatus, *Klein.* 90.
243. Atylosia Candollei, *W. & A.* 91.
Et-tóra, S.
A. albicans, *Benth.* 91.
A. rugosa, *W. & A.* 91.
Wal-kollu, S.
A. scarabæoides, *Benth.* 91.
(Cajanus indicus, *Spreng.*) 90. *Rata-tóra*, S. *Thava-rai*, *T.* *Pigeon Pea.*
244. Dunbaria ferruginea, *W. & A.* 90. C. P. 3961.
D. Heynei, *W. & A.* 90.
245. Eriosema chinense, *Vog.*
246. Rhynchosia rufescens, *DC.* 91.
R. nummularia, *DC.* *Nomismia.* 91.
R. aurea, *DC.*
R. suaveolens, *DC.* 442.
R. cana, *DC.* 91.
R. cyanosperma, *Benth.* *Cyanospermum tomentosum.* 92.
R. minima, *DC.* 91.
R. viscosa, *DC.* *R. villosula.* 412. C. P. 3895.

R. acutissima, *Thw.* 413.
R. densiflora, *DC.*
247. Flemingia strobilifera, *R. Br.* 92.
Hampilla, S.
F. lineata, *Roxb.* 92.
F. congesta, *Roxb.* 92.
var. semialata, *Roxb.* (sp.) 92.
248. (Dalbergia latifolia, *Roxb.*)
D. Championii, *Thw.* 94.
Bambara-wel, S.
D. frondosa, *Roxb.* 94.
Vel-urruvai, T.
D. volubilis, *Roxb.* ("Mrs. Walker.")
D. monosperma, *Dalz.* 94.
249. Pterocarpus Marsupium, *Roxb.* 92.
Malu, Gammalu, S. *Vengai, Udida Vengai*, T.
250. Pongamia glabra, *Vent.* 92.
Magul-karanda, S. *Pungai, Punku*, T.
251. Derris scandens, *Benth.* 413.
Kala-wel, S.
D. PARVIFLORA, *Benth.* 413.
(D. robusta, *Benth.*)
D. uliginosa, *Benth.* 92.
D. PANICULATA, *Benth.* *D. Benthamii.* 413.
D. oblonga, *Benth.* 413.
D. sinuata, *Benth.* 93.
252. Sophora tomentosa, *L.* 94.
Mudu-murungá, S.
S. VIOLACEA, *Thw.* 94.
S. heptaphylla, *L.* 94.
253. PERICOPSIS MOONIANA, *Thw.* 413.
Nedun, S.
254. Cæsalpinia Bonduc, *Roxb.* *Guilandina.* 94.
Kumburu-wel, S.
C. Nuga, *Ait.* *C. paniculata.* 95.
Diya-wawuletiya, S.
(C. Sappan, *L.*) *Pattangi*, S. *Sappan.*
C. sepiaria, *Roxb.* 95.
[C. mimosoides, *Lam.*]
C. digyna, *Rottl.* 95.
255. Peltophorum ferrugineum, *Benth.* *Cæsalp. Gleniei.* 414.

256. Mezoneurum enneaphyllum, *W. & A.* 414.
Goḍa-wawuḷetiya, S.
M. pubescens, *Desf.*
257. Cassia Fistula, *L.* 95.
Ẹhẹla, S. *Kovani, Tirukkondai*, T.
C. marginata, *Roxb.* *C. Roxburghii.* 95.
Katu-wá, S. *Vákai.* T.
C. occidentalis, *L.* 95.
Peti-tóra, S.
C. Sophera, *L.* 95.
U'ru-tóra, S.
C. Tora, *L.*
Pẹni-tóra, S.
* C. tomentosa, *L.* 95.
(C. hirsuta, *L.*)
* C. lævigata, *Willd.*
C. auriculata, *L.* 96.
Raṇawará, S. *Avarai*, T.
C. obovata, *Collad.* *C. obtusa.* 441.
* C. alata, *L.* 97. *Raṭa-tóra*, S.
C. siamea, *Lam.* *C. florida.* 96.
Wá, Aramaná, S. *Wagé, Vákai*, T.
C. timoriensis, *DC.* 96.
(C. glauca, *Lam.*) 96.
var. suffruticosa, *Kœn.* (sp.) ? 441.
C. Absus, *L.* 96.
Bú-tóra, S.
C. Kleinii, *W. & A.* 96.
Bin-siyambalá, S.
[C. pumila, *L.*]
C. mimosoides, *L.* 96.
Bin-siyambalá, S.
var. auricoma, *Grah.* (sp.) var. *villosula.* 96.
var. Wallichiana, *Baker.* *C. Wallichiana.* 96.
258. Cynometra ramiflora, *L.* 97.
Gal-menḍóra, S.
var. heterophylla, *Thw.* 97.
(C. cauliflora, *L.*) *Niam-niam*, Malay.
259. Dialium ovoideum, *Thw.* 97.
Gal-siyambalá, S. *Katapuli*, T.
260. Crudia zeylanica, *Benth.* *Detarium*, 414.
261. Saraca indica, *L.* *Jonesia Asoka.* 97.
Diya-ratambalá, Diya-ratmal, S.

* Tamarindus indica, *L.* *T. officinalis.* 95.
Siyambalá, S. *Puli*, T. *Tamarind.*

262. Humboldtia laurifolia, *Vahl.* 97.
Gal-karanda, S.

263. Bauhinia tomentosa, *L.* 98.
Petaṉ, kaha-petaṉ, S. *Tiruvatti, Kat-atti*, T.
(B. acuminata, *L.*)
B. racemosa, *Lam.* *Piliostigma.* 98.
Mayila, S.
† B. anguina, *Roxb.*

264. Neptunia oleracea, *Lour.* 99.
Gas-nidi-kumba, S.
(N. plena, *Benth.*)

265. Entada scandens, *Benth.* 98.
Pus-weḷ, S.

266. Adenanthera pavonina, *L.* 98.
Madaṭiya, S. *Ani-kundumani*, T.
A. bicolor, *Moon.* 98.
Mas-mora, S.

267. Dichrostachys cinerea, *W. & A.* 99.
Andara, S. *Wara, Vadatara*, T.
(Desmanthus vrigatus, *Willd.*) 98.
* Leucæna glauca, *Benth.*
* Mimosa pudica, *L.* 99.
Midi, S.

268. * Acacia Farnesiana, *Willd.* 99.
Síniya, S.
A. planifrons, *W. & A.*
Odái, T.
A. arabica, *Willd.* 415.
Kari-velam, T.
A. eburnea, *Willd.* 99.
Odái-velam, T.
A. tomentosa, *Willd.* 99.
Ani-mullu, T.
A. leucophlœa, *Willd.* 99.
Maha-andara, Kaṭu-andara, S. *Velam, Vel-Velam*, T.
A. Suma, *Kurz.* *A. Catechu*, (part.) 99.
A. Sundra, *DC.* *A. Catechu*, (part.) 99.
Rat-kihiri, S. *Vanni*, T.
A. ferruginea, *DC.*

A. concinna, *DC.* 99.
Hinguru, S.
A. cæsia, *Willd.* *A. Intsia.* 99.
A. pennata, *Willd.* 99.
269. Albizzia Lebbek, *Benth.* 99.
Márá, S. *Manchadi, Kona, Ughil*, T.
A. odoratissima, *Benth.* 100.
Súriya-márá, S. *Karuvakái*, T.
A. stipulata, *Boiv.* 100.
Kabal-márá, Hulaṇ-márá, S.
A. amara, *Boiv.* 100.
270. Pithecolobium geminatum, *Benth.* 100.
P. umbellatum, *Benth.* 100.
Termaḷái, T.
P. bigeminum, *Benth.* 100.
Kalaṭiya, S.
P. subcoriaceum, *Thw.* 100.
Mímiṇi-márá, S.

45. Rosaceæ.

271. Pygeum Wightianum, *Bl.* 102.
Ununu, S.
var. parvifolium, *Thw.*
P. zeylanicum, *Gaertn.*
Kankumbal-koṭiya, Golu-mora, S.
272. Rubus glomeratus, *Bl.* *R. rugosus*, var. β. 101.
R. moluccanus, *L.* *R. rugosus*, var. α. 101.
Wel-buté, S.
var. Fairholmianus, *Gardn.* (sp.) *R. rugosus*, var. γ. 101.
var. macrocarpus, *Gardn.* (sp.) *R. rugosus*, var. δ. 101.
R. ellipticus, *Sm.* *R. flavus.* 101.
R. lasiocarpus, *Sm.* 101.
var. subglaber, *Thw.*
273. Potentilla Mooniana, *Wight.* 101.
P. Kleiniana, *W. & A.* 102.
274. Alchemilla indica, *Gardn.* *A. vulgaris*, var. *sarmentosa.* 102.
var. sibthorpioides, *Hk. f.*
275. Agrimonia zeylanica, *Moon.* *A. Eupatorium.* 102.
276. Poterium indicum, *Gardn.* 102.
277. Photinia Notoniana, *W. & A.* 100.

46. Saxifragaceæ.

278. Vahlia oldenlandioides, *Roxb.* 130.
[V. viscosa, *Roxb.*]

47. Crassulaceæ.

* Bryophyllum calycinum, *Salisb.* 129.
Akká-pána, Rata-gówá, S.
279. Kalanchoe floribunda, *W. & A.*, var. glabra, *Cl.* 129.
K. laciniata, *DC.* 129, 417.

48. Droseraceæ.

280. Drosera Burmanni, *Vahl.* 21.
Wata-ressa, S.
D. indica, *L.* 21.
Kandu-lessa, S.
D. peltata, *Sm.* *D. lunata.* 22.

49. Halorageæ.

281. Serpicula zeylanica, *Arn.* *S. indica* (part.) 123.
var. minor, *Clarke.*
S. indica, *Thw.* 123.
282. Myriophyllum indicum, *Willd.* 123.
283. Callitriche stagnalis, *Scop.* *C. verna.* 290.

50. Rhizophoraceæ.

284. Rhizophora mucronata, *Lam.* 120.
Kadol, S. *Kandol*, T.
R. conjugata, *L.* 120.
Kadol, S. *Kandol*, T.
285. Ceriops Candolleana, *Arn.* 120.
[Kandelia Rheedii, *W. & A.*]
286. Bruguiera gymnorhiza, *Lam.* Includes *B. Rheedii.* 120.
B. caryophylloides, *Bl.* *Kanilia.* 120.
287. Carallia integerrima, *DC.* 120.
Dawata, S.
C. calycina, *Thw.* 121.
Ubbériya, S.
288. Weihea zeylanica, *Baill.* *Anstrutheria.* 121.
Kannu, T.
289. Anisophyllea zeylanica, *Benth.* 119.
Weli-penna, Weli-piyáná, S.

51. Combretaceæ.

290. (Terminalia Catappa, *L.*) *Koṭṭambá*, S. *Kottai*, T.
Indian Almond.
T. Belerica, *Roxb.* 103.
Bulu, S. *Tándi*, T.
var. laurinoides, *Miq.*
T. Chebula, *Retz.* 103.
Aralu, S. *Kadukkâi*, T.
T. PARVIFLORA, *Thw.* 103.
Hanpalandá, S.
T. glabra, *W. & A.* 104.
Kumbuk, S. *Marutu*, T.
[T. tomentosa, *Bedd.*]
291. Anogeissus latifolia, *Wall.* *Conocarpus.* 103.
Dawu, S. *Vekkali*, T.
292. Lumnitzera racemosa, *Willd.* 103.
Bériya, S.
293. Combretum acuminatum, *Roxb.* *C. sarcopterum.* 415.
C. ovalifolium, *Roxb.* *C. Wightianum* (part.) 103.
Kaduruketiya-wel, S.
C. extensum, *Roxb.* *C. Wightianum* (part.) 103.
294. Gyrocarpus Jacquini, *Roxb.* *G. asiaticus.* 258.
Híma, S. *Tanukku*, T.

52. Myrtaceæ.

(Psidium Guyava, *L.* *Péra*, S. *Guava.*)
295. Rhodomyrtus tomentosa, *Wight.* *Myrtus.* 114.
296. Eugenia aquea, *Burm.* *Jambosa.* 115.
Wal-jambu, S.
E. grandis, *Wight.* *Syzygium firmum.* 417.
E. hemispherica, *Wight.* *Strongylocalyx.* 116.
E. CYLINDRICA, *Wight.* *Jambosa.* 115.
E. MICRANTHA, *Duth.* *Syzygium.* 117.
E. lanceolata, *Lam.* *Acmena.* 119.
E. zeylanica, *Wight* (*non Willd.*) *Acmena.* 118.
Maran, Maranda, S. *Marungi*, T.
E. lissophylla, *Duth.* *Syzygium.* 118.
E. Gardneri, *Duth.* *Syzygium.* 117.
E. SUBAVENIS, *Duth.* *S. umbrosum.* 118.
E. caryophyllæa, *Wight.* *Syzygium.* 117.
Dan, Hín-dan, S.
E. CORDIFOLIA, *Wight.* *Syzygium.* 116.

E. revoluta, *Wight.* *Syzygium.* 117.
E. sylvestris, *Moon.* *Syzygium.* 116.
Alubó, S.
E. ASSIMILIS, *Duth.* *Syzygium.* 116.
E. NEESIANA, *Wight.* *Syzygium.* 117 & C. P. 4013.
Panukẹra, S.
E. CYCLOPHYLLA, *Thw. (in Fl. B. Ind.)* C. P. 3915.
E. SCLEROPHYLLA, *Duth.* *Syzygium.* 118.
E. ROTUNDIFOLIA, *Wight.* *Syzygium.* 118.
E. CALOPHYLLIFOLIA, *Wight.* *Syzygium.* 118.
E. OLIGANTHA, *Duth.* *Syzygium.* 118.
E. OLIVIFOLIA, *Duth.* *S. spathulatum.* 118.
E. operculata, *Roxb.* *S. nervosum.* 417.
Bạta-domba, Kobo-mal, S.
E. Jambolana, *Lam.* *Syzygium.* 417.
Maha-dan̥, S. *Nával, Peru-nával*, T.
var. caryophyllifolia, *Lam.* (sp.) var. *microcarpum.* 417.
E. PHILLYRÆOIDES, *Trim. ms.*
E. lucida, *Lam.* C. P. 3865.
E. bracteata, *Roxb.* 114.
Tẹmbiliya, S.
var. Roxburghii, *Duth.* *E. Willdenovii.* 114.
Kaiya, Káyán, Pandi-káyán, T.
E. TERPNOPHYLLA, *Thw.* 114.
E. XANTHOCARPA, *Thw.* 416.
E. HÆCKELIANA, *Trim. ms.*
E. RUFO-FULVA, *Thw.* 416.
E. FLOCCIFERA, *Thw.* 115.
E. FULVA, *Thw.* 115.
E. RIVULORUM, *Thw.* 115.
E. INSIGNIS, *Thw.* 416.
E. DECORA, *Thw.* 115.
E. AMŒNA, *Thw.* 114.
var. rotundata, *Trim. ms.* *E. Mooniana*, var. *β.* 114.
E. Mooniana, *Wight. (non Gardn.)* 114.
Pinibaru, S.
(E. uniflora, *L.*)
E. MABÆOIDES, *Wight.* 114.
E. THWAITESII, *Duth.* *E. concinna.* 416.

297. Barringtonia speciosa, *L.* 119.
Múdilla, S.

B. racemosa, *Bl.* (C. P. 3610.) 119.
Diya-midella, S.
B. ZEYLANICA, *Gardn.* *B. racemosa*, var. (C. P. 2682.) 119.
B. acutangula, *Gaertn.* 119.
Ela-midella, S. *Adampu, Radami*, T.
298. Careya arborea, *Gaertn.* 119.
Kahaṭa, S. *Ari-maru, Kasaddai, Panichai*, T.
Patana Oak.

53. Melastomaceæ.

299. Osbeckia cupularis, *Don*, var. erythrocephala, *Naud.* (sp.)
O. Leschenaultiana. 104.
var. parvifolia, *Arn.* (sp.)
O. RHEEDII, *Gardn.* 104.
O. zeylanica, *Willd.* 104.
O. BUXIFOLIA, *Arn.* 105.
var. minor, *Thw.*
var. Beckettii, *Thw.* *(in Triana Mon.)* C. P. 3908.
O. aspera, *Bl.* 105.
Bówiṭiyá, S.
var. Kleinii, *Arn.* (sp.)
var. minor, *Triana.* (sp.)
var. Wightiana, *Benth.* (sp.)
(O. glauca, *Benth.*)
O. WALKERI, *Arn.* 105.
O. RUBICUNDA, *Arn.* 105.
O. MOONII, *Thw.* 105.
O. octandra, *DC.* *O. virgata.* 105.
Hín-bówiṭiyá, S.
300. Melastoma malabathricum, *L.* 106.
Maha-bówiṭiyá, S.
301. Kendrickia Walkeri, *Hk. f.* *Pachycentria.* 107.
302. SONERILA ZEYLANICA, *W. & A.* 109 & C. P. 3893.
var. pumila, *Clarke.* *S. pumila.* 109.
var. Walkeræ, *Clarke.*
S. TOMENTELLA, *Thw.* 109.
S. Brunonis, *W. & A.* ("C. P. 662.")
S. pedunculosa, *Thw.* 109.
S. ARNOTTIANA, *Thw.* 108.
S. WIGHTIANA, *Arn.* C. P. 3907.
S. HOOKERIANA, *Arn.* 108.

S. GARDNERI, *Thw.* 107.
var. firma, *Triana.* C. P. 3873.
S. ROBUSTA, *Arn.* 107.
var. glabricaulis, *Thw.* C. P. 3955.
S. HARVEYI, *Thw.* 107.
S. AFFINIS, *Arn.* 109.
var. rostrata, *Clarke.* *S. rostrata.* 108.
S. RHOMBIFOLIA, *Thw.* 108.
var. angustata, *Triana.* (sp.)
S. HIRSUTULA, *Arn.* 108.
S. PILOSULA, *Thw.* 108.
S. LANCEOLATA, *Thw.* 107.
S. GUNERATNEI, *Trim. ms.* C. P. 4012.
303. MEDINILLA FUCHSIOIDES, *Gardn.* 106.
M. MACULATA, *Gardn.* 106.
var. cuneata, *Thw.* 106.
304. MEMECYLON ARNOTTIANUM, *Wight.* 113.
M. GARDNERI, *Thw.* 113.
M. WIGHTII, *Thw.* 113.
M. HOOKERI, *Thw.* 113.
var. exalata, *Trim. ms.* C. P. 2686.*
Keviṭiya-kẹra, S.
M. ELEGANTULUM, *Thw.* 112.
M. ELLIPTICUM, *Thw.* 112.
M. VARIANS, *Thw.* 112.
var. parvifolium, *Thw.* (sp.) 113.
var. rotundatum. *Thw.* 112.
M. PROCERUM, *Thw.* 415.
M. OVOIDEUM, *Thw.* 112. Includes *M. macrocarpum.* 110.
M. MACROPHYLLUM, *Thw.* 111.
M. ORBICULARE, *Thw.* 112.
M. Heyneanum, *Benth.* *M. jambosoides.* 112.
var. latifolium, *Clarke.*
var. angustifolium, *Clarke.*
M. FUSCESCENS, *Thw.* 111.
Doḍaṉ-kaha, S.
M. ROSTRATUM, *Thw.* 111.
Kûrẹṭiya, S.
M. RHINOPHYLLUM, *Thw.* 110.
M. angustifolium, *Wight.* 111.
M. PHYLLANTHIFOLIUM, *Thw. (in Triana Mon.)* C. P. 3901.

M. lævigatum, *Bl.*, var. sylvaticum, *Cl.* *M. sylvaticum.* 110.
M. grande, *Retz.* *M. edule,* var. *β.* 110.
Doḍaṉ-weṉna, S.
M. capitellatum, *L.* 110.
Doḍaṉ-kaha, Weḷi-kaha, S. *Katti-kaiya, Mancha-varná,* T.
M. UMBELLATUM, *Burm.* 111. (C.P. 1561, 1562.)
Kora-kaha, S.
var. Thwaitesii, *Clarke.* (C. P. 387.)
M. edule, *Roxb.* 110.
var. ovatum, *Sm.* (sp.) var. *γ.* 110.
Dedi-kaha, S.
var. RUBRO-CŒRULEUM, *Clarke.* *M. rubro-cœruleum.* 415.
var. CUNEATUM, *Clarke.* *M. cuneatum.* 112.
var. LEUCANTHUM, *Clarke.* *M. leucanthum.* 110.

54. Lythraceæ.

305. Ammannia peploides, *Spreng.* *Ameletia indica.* 122.
A. Rotala, *F. Muell.* *Rotala verticillaris.* 122.
A. pentandra, *Roxb.* 122.
A. baccifera, *L.* *A. indica.* 121.
A. cordata, *W. & A.* *A. salicifolia.* var. *β.* 121.
A. lanceolata, *Heyne.* *A. salicifolia.* var. *a.* 121.
A. octandra, *L. f.* 121.
306. Woodfordia floribunda, *Sal.* *Grislea tomentosa.* 122.
Malita, S.
* Nesæa triflora, *H. B. K.* 417.
307. Pemphis acidula, *Forst.* 122.
308. Lawsonia alba, *Lam.* 122.
Marithondi, T. *Henna.* *Tree Mignonette.*
309. Lagerstrœmia Flos-reginæ, *Retz.* 122.
Muruta, S. *Kadalipuva,* T.
310. Sonneratia acida, *L. f.* 123.
Kirilla, S.
S. alba, *Sm.*
311. AXINANDRA ZEYLANICA, *Thw.* 122.
Keḳiri-wará, S.

55. Onagraceæ.

312. Jussiæa repens, *L.* 123.
Béru-diyanilla, S.

J. suffruticosa, *L.* *J. villosa.* 123.
var. angustifolia, *Lam.* (sp.) var. *subglabra.*
313. Ludwigia parviflora, *Roxb.* 123.
L. prostrata, *Roxb.* 123.
314. Trapa bispinosa, *Roxb.* 124.
Ikiliya, S.

56. Samydaceæ.

315. Casearia esculenta, *Roxb.* *C. zeylanica & C. varians,* (part.) 19.
Wal-waraká, S.
var. angusta, *Clarke.*
var. Championii, *Clarke.* *C. Championii.* 19.
C. CORIACEA, *Thw.* Includes *C. varians*, var. γ. 20.
C. tomentosa, *Roxb.* 19.
316. OSMELIA GARDNERI, *Thw.* 20.
317. Homalium zeylanicum, *Benth.* 410.
Liyan, S.

(Turneraceæ.)

* Turnera ulmifolia, *L.*

57. Passifloraceæ.

318. Modecca Wightiana, *Wall.* 128.
M. palmata, *Lam.* 128.
Hondala, Potu-honda, S.
* Passiflora suberosa, *L.*
* P. edulis, *Ait.*
* P. glauca, *Ait.*
* P. fœtida, *L.*
(Carica Papaya, *L.* *Pepol*, S. *Papaw.)*

58. Cucurbitaceæ.

319. Trichosanthes palmata, *Roxb.* 127.
Titta-hondala, S.
var. tomentosa, *Heyne.*
T. nervifolia, *L.* 127.
T. cucumerina, *L.* 126.
Dummella, S.
var. laciniosa, *Thw.*
(T. anguina, *L.*) *Patóla*, S. *Podivilángu*, T. *Snake Gourd.*
T. THWAITESII, *Cogn.* *T. integrifolia.* 127.
320. Gymnopetalum Wightii, *Arn.* 127.
var. tubiflorum, *Cogn.* (sp.) *G. zeylanicum.* 127.

(Lagenaria vulgaris, *Sér.*) *Diya-labu*, S. *Bottle Gourd.*
321. Luffa ægyptiaca, *Mill.* *L. pentandra.* 126.
Niyan-vęṭa-kolu, S.
L. acutangula, *Roxb.* 126.
Vęṭa-kolu, Dára-vęṭa-kolu, S. *Písukkaṇ-kái*, T.
var. amara, *Clarke.* *L. amara.* 417.
(Benincasa cerifera, *Savi.*) *Alu-puhul*, S. *Púsani-kái*, T. *Ash Pumpkin.*
322. Momordica Charantia, *L.* 126.
Karivila, S.
M. dioica, *Roxb.* 126.
Tumba Karivila, S.
M. DENUDATA, *Clarke.* *M. dioica*, var. 126.
323. Cucumis trigonus, *Roxb.* 127.
C. pubescens, *Willd.* 127.
Goṇ-kękiri, S.
324. Citrullus Colocynthis, *Schrad.* 126.
Yak-komaḍu, S. *Colocynth.*
(C. vulgaris, *Schrad.*) *Komaḍu*, S. *Water Melon.*
325. Cephalandra indica, *Naud.* *Coccinea.* 128.
Kówakká, S.
326. Bryonia laciniosa, *L.* 126.
(Cucurbita moschata, *Duch.*) *Raṭa-labu*, S. *Waṭṭak-kai*, T. *Pumpkin.*
327. Mukia scabrella, *Arn.* 125.
Hín-kękiri, S.
M. leiosperma, *Thw.* 125.
328. Zehneria Hookeriana, *Arn.* 125.
Z. umbellata, *Thw.* 125.
Kuḍu-kękiri, S.
329. MELOTHRIA ZEYLANICA, *Clarke.* *M. deltoidea.* 124.
330. Corallocarpus epigœa, *Hk. f.* *Æchmandra.* 125.
Go-palangá, S.
331. Cerasiocarpus zeylanicum, *Hk. f.* *Æchmandra.* 125.
332. Ctenolepis Garcini, *Naud.* *Zehneria.* 125.
333. Gynostemma pedata, *Bl.* *Pestalozzia laxa.* 124.
334. Zanonia indica, *L.* 124.
Wal-rasakinda, S.

59. Begoniaceæ.

335. Begonia cordifolia, *Thw.* 129.
B., sp. 129. (C. P. 3460.)

B. TENERA, *Dry.* *B. Thwaitesii.* 128. C. P. 3952.
B. THWAITESII, *Hook.* C. P. 3953.
B. subpeltata, *Wight.* 128.
B. malabarica, *Lam.* 128.
Maha-hakambalá, S.
var. dipetala, *Thw.* 128. C. P. 3949.

60. Datiscaceæ.

336. Tetrameles nudiflora, *R. Br.* 252.

61. Cactaceæ.

337. Rhipsalis Cassytha, *Gaertn.* 129.
* Opuntia Dillenii, *Haw.*
Kaṭupatuk, S.

62. Ficoideæ.

338. Sesuvium Portulacastrum, *L.* *S. repens.* 23.
339. Trianthema monogyna, *L.* *T. obcordata.* 23.
Hín-sárana, S.
T. crystallina, *Vahl.* 23.
T. decandra, *L.* 23.
Maha-sárana, S.
340. Mollugo hirta, *Thunb.* *Glinus dictamnoides.* 24.
M. Spergula, *L.* 24.
M. stricta, *L.* Includes *M. pentaphylla*, L. 24.
M. Cerviana, *Ser.* 24.
Patpaḍágam, T.
M. disticha, *Ser.* 24.
M. nudicaulis, *Lam.* 24.
341. Gisekia pharnaceoides, *L.* 250.

63. Umbelliferæ.

342. Hydrocotyle javanica, *Thunb.* 130.
Máha-goṭu-kola, S.
H. rotundifolia, *Roxb.* *H. nitidula.* 130.
H. asiatica, *L.* 130.
Hín-goṭu-kola, S. *Vallárai*, T.
343. Sanicula europœa, *L.* 130.
344. Bupleurum mucronatum, *W. & A.*, var. virgata, *Cl.* *B. falcatum*, var. 131.
Wal-enḍaru, S.
* Carum Roxburghianum, *Benth.*
[C. nothum, *Clarke.*]

345. Pimpinella Heyneana, *Wall.* *Helosciadium.* 130.
Wal-asamôdagan, S.
P. Leschenaultii, *DC.* 131.
346. PEUCEDANUM ZEYLANICUM, *Gardn.* *Palimbia ramosissima.* 131.
Wal-endaru, S.
347. Heracleum zeylanicum, *Gardn.* *H. Sprengelianum,* 131.
var. rigens, *Wall.* (sp.)

64. Araliaceæ.

(Panax fruticosum, *L.*)
[Pentapanax Leschenaultii, *Seem.*]
348. Polyscias acuminata, *Seem.* *Hedera.* 131.
349. Heptapleurum racemosum, *Bedd.* *Hedera.* 132.
H. EMARGINATUM, *Seem.* *Hedera.* 132.
H. stellatum, *Gaertn.* *Hedera Vahlii.* 132.
Itta, S.
H. exaltatum, *Seem.* *Hedera.* 132.
Goḍa-itta, S.

65. Cornaceæ.

350. Alangium Lamarckii, *Thw.* 133.
Alangi, T.
A. GLANDULOSUM, *Thw.* 133.
351. MASTIXIA TETRANDRA, *Clarke.* *Bursinopetalum.* 42.
var. Thwaitesii, *Clarke.* *var. β.* 42.
Diya-taliya, S.
M. arborea, *Clarke.* *Bursinopetalum.* 42.

GAMOPETALÆ.

66. Caprifoliaceæ.

352. Viburnum coriaceum, *Bl.* *V. hebanthum.** 136.
var. capitellata, *Clarke.*
var. ZEYLANICA, *Gardn.*
V. erubescens, *Wall,* 136.

67. Rubiaceæ.

353. Sarcocephalus cordatus, *Miq.* *Nauclea coadunata.* 137.
Bak-mí, S. *Vammi,* T.
354. Anthocephalus Cadamba, *Miq.* *Nauclea.* 137.
Vellai-kadamba, T.

355. Adina cordifolia, *Hk. f.* *Nauclea.* 137.
Koloṉ, S. *Manjaḷ-kadambu*, T.

356. Stephegyne parviflora, *Korth.* *Nauclea.* 137.
Heḷamba, S. *Nír-kadamba.* T.
S. tubulosa, *Hk. f.* *Nauclea.* 137.
var. minor, *Thw.*

357. NAUCLEA ZEYLANICA, *Hk. f.* *N. peduncularis.* 137.

358. Uncaria dasyoneura, *Korth.*, var. THWAITESII, *Hk. f.*
U. Gambier. 138.

359. Wendlandia Notoniana, *Wall.* 159.
Rawan-idala, S.
var. ZEYLANICA, *Hk. f.*

360. Dentella repens, *Forst.* 144.

361. NEUROCALYX ZEYLANICUS, *Hook.* 138.
N. Wightii, *Arn.* 138.
N. CAPITATA, *Benth.*
N. CHAMPIONII, *Benth.* 139.
N. GARDNERI, *Thw.* 139.

362. ALLÆOPHANIA DECIPIENS, *Thw.* Includes *Hedyotis nodulosa*, var. *a.* 143, 147.
var. flavescens, *Thw.* 147.
var. Arnottii, *Hk. f.* (sp.) ("C. P. 87.")

363. Fergusonia zeylanica, *Hk. f.* *Borreria tetracocca.* 442.

364. Hedyotis fruticosa, *L.* 142.
Weraṉiya, S.
H. EVENIA, *Thw.* 140.
H. CYMOSA, *Thw.* 142.
H. MACRÆI, *Hk. f.*
H. OBSCURA, *Thw.* 141.
var. minor, *Thw.* (*in Fl. Brit. Ind.*)
H. COPROSMOIDES, *Trim. ms.* *H. obscura*, var. *β.* 141.
H. QUINQUENERVIA, *Thw.* 141.
H. LESSERTIANA, *Arn.* 141.
var. major, *Thw.*
var. confertiflora, *Thw.* Includes *H. flavescens*, 141, 419, & C.P. 3935.
H. RHINOPHYLLA, *Thw. ms.* C. P. 3984.
H. GARDNERI. *Thw.* 142.
H. MEMBRANACEA, *Thw.* 143.
H. THWAITESII, *Hk. f.* *H. macrophylla.* 142.

H. NODULOSA, *Arn.* *Var. β.* 143.
var. Walkeri, *Hk. f.*
H. CINEREO-VIRIDIS, *Thw.* 419.
var. subverticillata. *Trim. ms.* *Var. β.* 419.
var. fumata, *Thw. ms.* C. P. 3909 (part.)
var. truncata, *Trim. ms.* C. P. 3909 (part.)
H. verticillaris, *W. & A.* 142.
H. Lawsoniæ, *W. & A.* 140.
H. auricularia, *L.* 142.
Geta-kola, S.
H. cœrulea, *W. & A.* 144.
H. nitida, *W. & A.* 143.
Pita-sudu-palá, S.
H. INAMŒNA, *Thw.* 143.
H. CYANESCENS, *Thw.* 143.

365. Oldenlandia corymbosa, *L.* *Hedyotis Burmanniana.* 144.
Wal-patpádagam, S.
var. racemosa, *Thw.* 419.
O. diffusa, *Roxb.* *Hed. Burmanniana*, var. *brachypoda.* 419.
O. Heynei, *Br.* *Hedyotis.* 144.
O. umbellata, *L.* *Hedyotis.* 144.
Saya-mul, S. *Saya*, T. *Chay Root.*
O. trinervia, *Retz.* *Hedyotis.* 144.
O. stricta, *L.* *Hed. maritima.* 144.
O. biflora, *L.* (Includes *O. paniculata*, L.) *Hedyotis racemosa.* 144.

366. Anotis quadrilocularis, *Hk. f.* *Hedyotis.* 144.
A. NUMMULARIA, *Hk. f.* *Hedyotis.* 142.
A. NUMMULARIFORMIS, (*Arn.*) *H. nummularia*, var. *glabra.* 142.
A. RICHARDIANA, (*Arn.*) *H. monosperma*, var. *subglabra.* 142.

367. Ophiorrhiza Mungos, *L.* 139.
Dat-ketiyá, S.
var. NEMOROSA, *Hk. f.* *O. nemorosa.* 139.
var. ANGUSTIFOLIA, *Hk. f.* *O. angustifolia.* 140.
O. Harrisiana, *Heyne.* var. decumbens, *Hk. f.* *O. decumbens.* 419.
O. RADICANS, *Gardn.* 139.
O. pectinata, *Arn.* 140.
var. imbricata, *Gardn.* (sp.)

O. PALLIDA, *Thw.* 140.
O. GLECHOMIFOLIA, *Thw.* 140.
368. Mussænda frondosa, *L.* 138.
Mussenda, Wel-but-sarana, S.
369. ACRANTHERA ZEYLANICA, *Arn.* 138.
370. LEUCOCODON RETICULATUM, *Gardn.* 138.
371. UROPHYLLUM ELLIPTICUM, *Thw.* 419.
U. ZEYLANICUM, *Thw.* 418.
372. SCHIZOSTIGMA HIRSUTUM, *Arn.* 139.
373. Webera corymbosa, *Willd.* *Stylocoryne Webera.* 158.
Tarana, S. *Taranai,* T.
var. montana, *Thw.*
374. BYRSOPHYLLUM ELLIPTICUM, *Bedd.* *Stylocoryne.* 421.
375. Randia uliginosa, *DC.* 159.
Weideya, Et-kukurumán, S.
R. dumetorum, *Lam.* 159.
Kukurumán, S.
R. malabarica, *Lam.* *Griffithia fragrans.* 158.
R. GARDNERI, *Hk. f.* *Griffithia.* 158.
Ataketiya, S.
R. rugulosa, *Hk. f.* *Griffithia.* 159.
376. Gardenia latifolia, *Ait.* 159.
Galis, S. *Kumbai,* T.
G. carinata, *Wall.* 159.
377. NARGEDIA MACROCARPA, *Bedd.* *Hyptianthera.* 157.
378. SCYPHOSTACHYS PEDUNCULARIS, *Thw.* 157.
S. COFFÆOIDES, *Thw.* 157.
Wal-kópi, S.
379. DIPLOSPORA DALZELLII, *Hk. f.* *Discospermum.* 158.
D. ERYTHROSPORA, *Hk. f.* *Discospermum.* 158.
380. Scyphiphora hydrophyllacea, *Gaertn.* *Epithinia malayana.* 157.
381. Guettarda speciosa, *L.* 153.
Wal-pichcha, S. *Paneer,* T.
382. Timonius Jambosella, *Thw.* 153.
Peddi-méla, Angana, S.
383. DICHILANTHE ZEYLANICA, *Thw.* 136.
384. KNOXIA CORYMBOSA, *Willd.* *K. stricta.* 152.
K. mollis, *W. & A.* *K. corymbosa.* 151.
K. ZEYLANICA, *L.* 152.
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K. PLATYCARPA, *Arn.* 152.
var. hirsuta, *Thw.*
var. foliosa, *Thw.*
var. spicata, *Thw. ms.* C. P. 3996.

385. Canthium didymum, *Roxb.* 152.
Porawa-márá, Gal-karanda, S. *Yerkoli.* T.
var. LANCEOLATUM, *Thw.*
var. GRANDIFOLIUM, *Thw.*
C. MONTANUM, *Thw.* 152.
C. PUBERULUM, *Thw. (in Fl. Brit. Ind.)* C. P. 3995.
C. Rheedii, *DC.* 153.
var. minus, *Thw.*
C. MACROCARPUM, *Thw.* 152.
C. CAMPANULATUM, *Thw.* 153.
C. parviflorum, *Lam.* 152.
Kára, S. *Kárai*, T.

386. IXORA CALYCINA, *Thw.* 155.
I. THWAITESII, *Hk. f.* *I. acuminata.* 155.
var. pubescens.
I. parviflora, *Vahl.* 155.
Maha-ratambalá, S. *Karankuttai, Punkirai*, T.
var. ZEYLANICA, *Hk. f.* *I. jucunda*, var. γ. 155.
I. JUCUNDA, *Thw.* 155.
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387. Pavetta indica, *L.* 155.
Páwaṭṭá, S.
var. MONTANA, *Thw.* 156.
P. hispidula, *W. & A.* 156.
var. (? hybrid) ZEYLANICA, *Hk. f.* C. P. 3924.
P. ANGUSTIFOLIA, *Thw.* 156.
P. INVOLUCRATA, *Thw.* 156.
P. GLENIEI, *Thw. (in Fl. Brit. Ind.)* *P. tomentosa.* 156.

388. Coffea Wightiana, *W. & A.* 154.
C. travancorensis, *W. & A.* 154.
Gas-pichcha, S.

389. Morinda citrifolia, *L.*, var. bracteata, *Hk. f.* *M. bracteata*, 144.
Ahu, S.
M. tinctoria, *Roxb.* 145.
Ahu, S.

M. umbellata, *L.* 145.
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390. Prismatomeris albidiflora, *Thw.* 154.
var. FERGUSONII, *Thw. (in Bedd. Fl. Sylv.)* (sp.)

391. PSYCHOTRIA STENOPHYLLA, *Hk. f.* *Grumilea.* 147.
P. GLANDULIFERA, *Thw. (in Fl. Brit. Ind.)* C. P. 3911.
P. GARDNERI, *Hk. f.* *Grumilea.* 147.
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392. Chasalia curviflora, *Thw.* 150.

393. Geophila reniformis, *Don.* 150.
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394. LASIANTHUS MOONII, *Wight.* 420. (145.)
var. subglabra, *Thw. ms.* C. P. 3997.
L. THWAITESII, *Hk. f.* *L. strigosus* (part.) 420.
L. RHINOPHYLLUS, *Thw.* 420.
L. WALKERIANUS, *Wight.* *L. protractus*, (part.) and *L. varians*, (part.) 420.
var. lanceolatus, *Hk. f.* ("C. P. 340.")
L. OLIGANTHUS, *Thw.* 420.
L. GARDNERI, *Hk. f.* *L. strigosus* (part.) 420, and C. P. 3985.
L. STRIGOSUS, *Wight.* *(non Thw.)* *L. Walkerianus* and *L. varians* (part.) 420.
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S. hispida, *L.* 151.
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68. Valerianaceæ.

400. Valeriana Moonii, *Arn.* *V. Hardwickii.* 159.

69. Dipsacaceæ.

401. Dipsacus Walkeri, *Arn.* 421.

70. Compositæ.

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† V. anthelmintica, *L.* 160.
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403. Elephantopus scaber, *L.* 161.
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404. Adenostemma viscosum, *Forst.* 162.
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* Ageratum conyzoides, *L.* 161.
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407. Myriactis Wightii, *DC.* 162.
408. Lagenophora Billardieri, *Cass.*, var. Harveyi. *L. Harveyi.* 162.
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443. Vaccinium Leschenaultii, *Wight.* 170.
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445. Rhododendron arboreum, *Sm.*, var. nilagiricum, *Zenk.* (sp.) 170.
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446. Plumbago zeylanica, *L.* 244.
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447. Lysimachia ramosa, *Wall.*, var. ZEYLANICA, *Hk. f.* 172.
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453. Chrysophyllum Roxburghii, *G. Don*, var. sumatranum, *Miq.* (sp.) 174.
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454. Sideroxylon tomentosum, *Roxb.* *Sapota elengoides.* 175.
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458. Mimusops Elengi, *L.* 175.
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459. MABA ACUMINATA, *Hiern.* *Macreightia.* 424.
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D. OPACA, *Clarke.* ("C. P. 2924 in part.")
D. pruriens, *Dalz.* ? 423.

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O. polygama, *Wight.* *O. Gardneri.* 188.

465. Ligustrum Walkeri, *Decaisne.* *L. robustum.* 188.

83. Salvadoraceæ.

466. Salvadora persica, *Garcin.* *S. Wightiana.* 190.
Ughai, T. *Mustard Tree.*
467. Azima tetracantha, *Lam.* 191.
Wẹl-dehi, S.

84. Apocynaceæ.

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469. Carissa Carandas, *L.* 191.
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C. spinarum, *L.* *C. diffusa.* 191.
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R. densiflora, *Benth.* *Ophioxylon.* 191.
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472. Hunteria corymbosa, *Roxb.* *H. zeylanica.* 191.
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476. TABERNÆMONTANA DICHOTOMA, *Roxb.* 192.
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477. HOLARRHENA MITIS, *Brown.* 194.
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479. Vallaris Heynei, *Spreng.* *V. dichotoma.* 192.
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491. Calotropis gigantea, *Brown.* 196.
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* Asclepias curassavica, *L.*
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496. Gymnema sylvestre, *Brown.* 197. (C. P. 2549.)
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G. ROTUNDATUM, *Thw.* 197.
G. lactiferum, *Brown.* 198.
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507. Boucerosia umbellata, *W. & A.* 200.

86. Loganiaceæ.

508. Mitrasacme alsinoides, *Brown.* *M. indica.* 200.
509. Fagræa zeylanica, *Thunb.* 200.
Etamburu, S.
F. obovata, *Wall.* 200.
var. GARDNERI, *Clarke.* *F. Gardneri.* 200.
510. STRYCHNOS MICRANTHA, *Thw.* (in part.) 425.
S. colubrina, *L.*, var. ZEYLANICA, *Cl.* 201.
S. BENTHAMI, *Clarke.* *S. minor.* 201.
var. parviflora, *Benth.*
S. Beddomei, *Clarke.* *S. micrantha* (part.) 425.
var. CORIACEA, *Thw.* (sp.) 425.
S. CINNAMOMIFOLIA, *Thw.* 201.
Eta-kirinda-wel, S.

S. Nux-vomica, *L.* 201.
Goḍa-kaduru, S. *Yetti*, *Kánchúrai*, T.
S. potatorum, *L. f.* 201.
Ingini, S. *Téttán*, T.
511. Gaertnera Kœnigii, *Wight.* 202.
Péra-tambala, S.
var. thyrsiflora, *Thw.*
var. DIVARICATA, *Clarke.* *G. divaricata.* 425 (149).
G. ROSEA, *Thw.* 201.
G. WALKERI, *Wight.* 202.
var. Gardneri, *Cl.* *G. Gardneri.* 202.
G. TERNIFOLIA, *Thw.* 202.

87. Gentianaceæ.

512. EXACUM AXILLARE, *Thw.* 203.
var. pentamera, *Clarke.*
E. WALKERI, *Arn.* Includes *E. zeylanicum*, var. *β.* 203.
E. ZEYLANICUM, *Roxb.* 203.
Bindara, *Kirihiriya*, S.
var. macranthum, *Clarke.* *E. macranthum.* 203.
E. pedunculatum, *L.* 203.
E. sessile, *L.* 203.
[E. petiolare, *Griseb.*]
513. Hoppea fastigiata, *Clarke.* *Pladera pusilla.* 204.
514. Enicostema littorale, *Bl.* *Slevogtia orientalis.* 204.
Vallarugu, T.
515. Canscora diffusa, *Brown.* 204.
C. sessiliflora, *R. & S.* 204.
C. decussata, *A. & S.* 204.
C. Wallichii, *Clarke.* *C. Roxburghii.* 442.
516. Crawfurdia japonica, *S. & Z.*, var. CHAMPIONI, *Gardn.* (sp.) *C. fasciculata.* 204.
517. Gentiana quadrifaria, *Bl.* *G. pedicellata.* 204.
518. SWERTIA ZEYLANICA, *Gardn.* *Ophelia.* 205.
[S. Chirata, *Ham.* *Ophelia.* 426.]
519. Limnanthemum cristatum, *Griseb.* 205.
L. indicum, *Thw.* 205.
O'lu, *Ambala*, S.
L. aurantiacum, *Dalz.* *L. biflorum.* 205.
Rénu-ólu, S.
? L. FORBESIANUM, *Griseb.* ("MacRae, 86, 87.")
L. parvifolium, *Griseb.*, var. Moonii, *Cl.* *L. Moonii.* 205.
Bin-ólu, S.

88. Hydrophyllaceæ.

520. Hydrolea zeylanica, *Vahl.* 209.
Diya-kirilla, S.

89. Boragineæ.

521. Cordia Myxa, *L.* *C. Myxa*, var. *minor.* 214.
Lolu, S. *Naruvili*, *Vidi*, T.
var. obliqua, *Willd.* (sp.) *C. Myxa.* 213
C. monoica, *Roxb.* *C. diversa.* 214.
C. OBLONGIFOLIA, *Thw.* 214.
C. Rothii, *R. & S.*
(C. salicifolia, *Cham.* *C. Roxburghii*, Clarke.)
522. Ehretia lævis, *Roxb.* 214.
var. canarensis, *Miq.* (sp.)
Sira-pulichul, T.
(E. ovalifolia, *Wight.*)
E. buxifolia, *Roxb.* 214.
Hín-tambala, S.
523. Coldenia procumbens, *L.* 215.
Serappadi, T.
524. Rhabdia lycioides, *Mart.* 214.
525. Tournefortia argentea, *L. f.* 214.
Karon, S.
T. WALKERÆ, *Clarke.* *T. Wallichii.* 214.
526. Heliotropium supinum, *L.*, var. malabaricum, *Benth.* 215.
H. paniculatum, *Brown.* *H. linifolium.* 215.
H. bracteatum, *DC.*
var. laxiflora, *DC.* (sp.)
H. marifolium, *Retz.*, var. Wallichii, *Clarke.*
H. scabrum, *Retz.* ? *H. marifolium.* 215.
H. indicum, *L.* *Heliophytum.* 215.
527. Trichodesma indicum, *Brown.* 216.
T. zeylanicum, *Brown.* 216.
528. Cynoglossum furcatum, *Wall.* 215.
Bu-kattu-hẹnda, S.
var. lanceolatum, *Clarke.* *C. micranthum.* 215.
[C. denticulatum, *A. DC.*, var. zeylanicum, *Clarke.*]

90. Convolvulaceæ.

529. Ericybe paniculata, *Roxb.* 213.
Ẹta-míriya, S.
530. Rivea ornata, *Chois.* 209.

531. Argyreia tiliæfolia, *Wight.* *Rivea.* 209.
Má-banḍá, S.
* A. speciosa, *Sweet.* 210.
Maha-dumudu, S.
A. splendens, *Sweet.* 210.
A. POPULIFOLIA, *Chois.* *Rivea zeylanica*, var. a. 209.
Giri-tilla, S.
var. Thwaitesii, *Clarke.*
var. coacta, (*Clarke.*) *Rivea zeylanica*, var. β. 209.
A. pomacea, *Chois.*, var. TRIFLORA, *Cl.* *A. Leschenaultii.* 210.
532. Lettsomia aggregata, *Roxb.*, var. osyrensis, *Clarke.* *Argyreia.* 210.
L. elliptica, *Wight.* *Argyreia.* 210.
[L. setosa, *Roxb.*]
L. HANCORNIÆFOLIA, *Clarke.* *Argyreia.* 210.
533. Ipomœa Bona-nox, *L.*, var. grandiflora, *Roxb.* *Calonyction speciosum.* 211.
A'lan̥gá, S. *Moon-flower.*
(I. muricata, *Jacq.*) *Kalu-álan̥gá*, S. (C. P. 3580.)
I. grandiflora, *Lam.*, *(non Roxb.)* *Calonyction comospermum.* 211.
I. JUCUNDA, *Thw.* 211.
* I. coccinea, *L.*
* I. Quamoclit, *L.*
I. hederacea, *Jacq.* *Pharbitis Nil.* 210.
I. dissecta, *Willd. (non Pursh)* *I. coptica.* 212.
I. uniflora, *R. & S.* *Aniseia.* 212.
Potu-palá, S.
I. digitata, *L.* *Batatas paniculata.* 210.
Kiri-badu, S.
(I. Batatas, *Lam.*) *Batala*, S. *Sweet Potato.*
I. Choisyana (*Wight.*) *Batatas.* 210.
* I. cissoides, *Chois.* (C. P. 1491.)
I. pileata, *Roxb.* 212.
I. Wightii, *Chois.* 212.
† I. bracteata, *Wight.*
I. Pes-tigridis, *L.* 212.
Divi-aḍiya, Divi-pahuru, S.
var. hepaticifolia, *L.* (sp.)
I. eriocarpa, *Brown.* *I. sessiliflora.* 212.
I. angustifolia, *Jacq.* *I. tridentata*, var. β. 211.

I. tridentata, *Roth.* 211.
Hawari-madu, Hín-madu, S.
I. chryseides, *Ker.* 212.
Kaha-tel-kola, S.
I. reniformis, *Chois.* 211.
I. obscura, *Ker.* 212.
Maha-madu, S.
I. Gleniei, *Thw.* (*in Fl. B. Ind.*)
I. denticulata, *Chois.* *I. littoralis.* 211.
I. sepiaria, *Koen.* 212.
Rasa-tel-kola, S.
var. sagittata, *Thw.* 212.
I. Beladamboe, *R. & S.* *I. rugosa.* 211.
Bin-tamburu, S.
I. aquatica, *Forsk.* *I. reptans.* 211 and C. P. 3941.
Kaṉ-kuṉ, S.
I. staphylina, *R. & S.*
I. campanulata, *L.* 211.
I. cymosa, *R. & S.* 212.
Kiri-madu, S.
* I. sidæfolia, *Chois.*
I. Turpethum, *Brown.* 212.
Trasta-wálu, S.
I. biloba, *Forsk.* *I. Pes-capræ.* 211.
Mudu-bin-tamburu, S.
I. vitifolia, *Sweet.* 426.
[I. centrocaulos, *Clarke.*]
* I. tuberosa, *L.*
I. palmata, *Forsk.* 212.
534. Hewittia bicolor, *Wight.* *Shutereia.* 212.
Wal-trasta-wálu, S.
[Calystegia hederacea, *Wall.*]
535. Convolvulus parviflorus, *Vahl.*
536. Evolvulus alsinoides, *L.* 213.
Visnu-kránti, S.
(Porana paniculata, *Roxb.*)
537. Breweria cordata, *Bl.* *B. Roxburghii.* 213.
538. Cressa cretica, *L.*, var. indica, *Retz.* (sp.) 213
539. Cuscuta reflexa, *L.* 213.
Aga-mula-ṇeti-wẹl, S.
C. chinensis, *Lam.* 213.

91. Solanaceæ.

540. Solanum nigrum, *L.* 216.
Kalu-kan-wériya, S. *Mana-takkáḷli*, T.
S. verbascifolium, *L.* 216.
Hekarilla, S.
var. auriculatum. *S. auriculatum.* 216.
S. pubescens, *Willd.* 216.
S. bigeminatum, *Nees*, var. ZEYLANICA, *Cl.* *S. membranaceum.* 216.
S. denticulatum, *Bl.* 216.
var. Gonakai, *Dun.* (sp.)
S. giganteum, *Jacq.* 216.
S. ferox, L. 216.
Mala-baṭu, S.
S. torvum, *Sw.* 216.
S. indicum, *L.* 217.
Tibbaṭu, S.
S. xanthocarpum, *Schrad. & Wendl.* 217.
Ela-baṭu, S.
var. Jacquini, *Thw.*
Kaṭu-weḷ-baṭu, S.
S. trilobatum, *L.* 217.
Wal-tibbaṭu, S.
* Physalis minima, *L.* 217.
* P. angulata, *L.* 217.
Mottu, S.
* P. peruviana, *L.* *Cape Gooseberry.*
* Capsicum fastigiatum, *Bl.*
Nayi-miris, S. *Bird Pepper.*
541. Withania somnifera, *Dun.* 217.
Amukkará, S. *Amkulang*, T.
* Nicandra physaloides, *Gaertn.*
542. Datura fastuosa, *L.* 217.
Attana, S.
var. Metel, *L.* (sp.)
* D. Stramonium, *L.*
Thorn-apple.
* D. suaveolens, *H. B. K.*
Rata-attana, S.

92. Scrophulariaceæ.

* Verbascum Thapsus, *L.* *Mullein.*
543. Celsia coromandelina, *Vahl.* 217.

* Calceolaria chelidonioides, *H. B. & K.*
[Linaria ramosissima, *Roxb.*]
544. ADENOSMA SUBREPENS, *Benth. Pterostigma.* 426, & *Lindenbergia urticæfolia.* 218.
A. CAMPHORATUM, *Hk. f. Pterostigma villosum.* 218.
Kaha-góna-kola, S.
A. capitatum, *Benth. Pterostigma.* 218.
Nil-góna-kola, S.
545. Limnophila conferta, *Benth. L. serrata.* 218.
L. laxa, *Benth.*
L. gratissima, *Bl. L. punctata.* 218.
L. hirsuta, *Benth.* 218.
L. sessiliflora, *Bl.*
L. heterophylla, *Benth. L. sessiliflora* (in part.) 218.
L. racemosa, *Benth.* 218.
L. gratioloides, *Br.* 218.
546. Herpestis Monniera, *H. B. & K.*
Lunu-wila, S. 218.
H. floribunda, *Br.*
547. Dopatrium nudicaule, *Ham.* 218.
D. junceum, *Ham.* 219.
D. lobelioides, *Benth.* 219.
548. Artanema sesamoides, *Benth.* 219.
549. Torenia asiatica, *L.* 219.
Kotalá-wẹl, S.
var. parvifolia, *Hk. f.*
T. hirtella, *Hk. f. T. rubens.* 219.
var. glabra, *Trim. ms.*
550. Vandellia crustacea, *Benth.* 219.
V. hirsuta, *Benth. V. multiflora.* 219.
V. scabra, *Benth.* 219.
V. pedunculata, *Benth.* 219.
V. angustifolia, *Benth.* 219.
551. Ilysanthes hyssopioides, *Benth.* 219.
I. rotundifolia, *Benth. I. hyssopioides* (part). 219.
552. Bonnaya veronicæfolia, *Spreng.* 219.
Wila, S.
B. brachiata, *Link & Otto.* 426.
B. tenuifolia, *Spreng.* 220.
553. Microcarpæa muscosa, *Br.* 220.
554. Peplidium humifusum, *Del.* 426.
555. ? Glossostigma spathulatum, *Arn.*

* Scoparia dulcis, *L.* C. P. 4014.
* Veronica polita, *Fries.*
[Buchnera hispida, *Ham.*] 220.
556. Striga orobanchoides, *Benth.*
S. lutea, *Lour.* *S. hirsuta.* 220.
S. euphrasioides, *Benth.* 220.
557. Centranthera procumbens, *Benth.* *C. Brunoniana.* 220.
Duṭu-saṭuṭu, S.
C. hispida, *Br.* 220.
C. humifusa, *Wall.* 221.
558. Sopubia delphinifolia, *G. Don.* 220.
S. trifida, *Ham.* 220.
559. Pedicularis zeylanica, *Benth.* 221.

93. Orobanchaceæ.

560. Æginetia indica, *Roxb.* 221.
Æ. pedunculata, *Wall.* *Æ. acaulis*, var. *α*. 221.
561. Campbellia cytinoides, *Wight.* 427.
562. Christisonia subacaulis, *Gardn.* *Æginetia acaulis*, var. *β*. 221.
C. THWAITESII, *Trim. ms.* *C. unicolor* (in part). 222. (C. P. 2971.)
? C. unicolor, *Gardn.* (C. P. 1780 ?) 222.
C. bicolor, *Gardn.* 222.
var. PALLIDIFLORA, *Thw.* 222.
var. SPECTABILIS, *Thw. ms.* (sp.) C. P. 3983.
C. ALBIDA, *Thw.* (*in Fl. Brit. Ind.*) C. P. 3929.
C. TRICOLOR, *Gardn.* 222.
var. grandiflora, *Hk. f.* *C. grandiflora.* 221.

94. Lentibulariaceæ.

563. Utricularia stellaris, *L. f.* C. P. 3960.
U. flexuosa, *Vahl.* 171.
U. exoleta, *Br.* *U. diantha.* 171.
U. affinis, *Wight.* *U. cœrulea*, var. 171.
U. cœrulea, *L.* 171.
U. reticulata, *L.* 171.
Nil-moṇaressa, S.
var. uliginosa, *Vahl.* var. *stricticaulis.* 171.
U. bifida, *L.* 171.
U. Wallichiana, *Wight.* *U. capillacea.* 171.
U. ROSEA, *Edgew.* *U. racemosa*, var. 172.

U. racemosa, *Wall.* 172.
U. orbiculata, *Wall.* 172.

95. Gesneraceæ.

564. Æschynanthus zeylanicus, *Gardn.* 206.
var. pinguis, *Clarke.*
565. Didymocarpus Humboldtianus, *Gardn.* 207.
var. primulæfolia, *Gardn.* (sp.) 207.
var. recedens, *Clarke.*
D. floccosus, *Thw.* 207.
D. zeylanicus, *Br.* 207.
566. Chirita Moonii, *Gardn.* 207.
C. Walkeri, *Gardn.* 207.
var. parviflora, *Clarke.* Var. β. 207.
C. zeylanica, *Hook.* 208.
var. angusta, *Clarke.* Var. β. 208.
567. Championia reticulata, *Gardn.* 20.
568. Klugia Notoniana, *A. DC.* 208.
Diyanilla, S.
var. glabra, *Gardn.* (sp.)
K. zeylanica, *Gardn.* 208.
[Rhynchoglossum obliquum, *Bl.*]
569. Epithema carnosum, *Benth.*, var. zeylanicum, *Gardn.* (sp.) 208.
var. hispidum, *Clarke.*
570. Isanthera permollis, *Nees.* 208.

96. Bignoniaceæ.

(Millingtonia hortensis, *L. f.*) *Indian Cork Tree.*
571. Oroxylum indicum, *Vent.* *Calosanthes indica.* 206.
Toṭila, S. *Achi*, T,
572. Dolichandrone Rheedii, *Seem.* *Spathodea.* 206.
Diya-dangá, S.
? D. crispa, *Seem.* ("Koenig.")
573. Stereospermum chelonioides, *DC.* 206.
Lunu-maḍalá, S. *Pátiri*, T.
(S. suaveolens, *DC.*) 206.

97. Pedaliaceæ.

* Martynia diandra, *Glox.*
Náka-táḷi, T.
574. Pedalium Murex, *L.* 209.
Ẹt-nerenchi, S.

* Sesamum indicum, *DC.* 209.
Tel-tala, S. *Ellu*, T. *Gingely.*
var. occidentale, *Heer & Reg.* (sp.) 442.

98. Acanthaceæ.

575. Thunbergia fragrans, *Roxb.* 224.
var. vestita, *Nees.*
* T. alata, *Boj.*
(T. Hawtayneana, *Wall.*) 224.
(T. coccinea, *Wall.*) 223.
576. Elytraria crenata, *Vahl.* 224.
var. lyrata, *Nees.*
577. Nelsonia campestris, *Br.* *N. tomentosa.* 224.
578. Ebermaiera zeylanica, *Nees.* *E. glauca.* 224.
579. Cardanthera uliginosa, *Ham.*
C. balsamica, *Benth.* *Adenosma.* 224.
C. verticillata, *Benth.* *Adenosma.* 224.
C. Thwaitesii, *Benth.* *Adenosma.* 224.
580. Hygrophila salicifolia, *Nees.* *H. quadrivalvis,* var. 225.
H. quadrivalvis, *Nees.* 225.
H. spinosa, *T. And.* 225.
Katu-ikiri, S. *Neer-mulli,* T.
581. Calophanes Nagchana, *Nees.* *C. depressa.* 225.
C. littoralis, *T. And.* 225.
582. Ruellia ringens, *L.*, var. dejecta, *Clarke.* *R. prostrata.* 225.
R. patula, *Jacq.* 225.
[R. repens, *L.*]
583. Phaylopsis parviflora, *Willd.* *Œtheilema reniforme.* 225.
584. Dædalacanthus montanus, *T. And.* 229.
[Hemigraphis flava, *Kurz.*] *Strobilanthes scaber.* 227.
585. Stenosiphonium Russellianum, *Nees.* 226.
var. subsericeum, *Nees.* (sp.) C. P. 3876.
Bú-nelu, S.
586. Strobilanthes viscosus, *T. And.* 226.
Nelu, S. (applied to the whole genus.)
S. stenodon, *Clarke.* C. P. 3874.
S. exareolatus, *Clarke.* *S. consanguineus.* 226.
S. rhytispermus, *Clarke.* *S. hypoleucus.* 226.
S. nigrescens, *T. And.* 226.
S. rhamnifolius, *T. And.* 226.
S. deflexus, *T. And.* 227.
S. lanceolatus, *Hook.* *S. adenophorus.* 228.

S. Walkeri, *Nees.* 227.
var. stenocarpus, *Clarke.* (C. P. 3517.)
S. Thwaitesii, *T. And.* 227.
S. caudatus, *T. And.* 228.
var. laniceps, *Clarke.*
S. anceps, *Nees.* 229.
S. punctatus, *Nees.* *S. anceps*, var. 228. C. P. 3998.
S. Arnottianus, *Nees.* 228.
S. asperrimus, *Nees.* *S. trifidus* (part). 228.
S. trifidus, *Nees.* 228.
S. exsertus, *Clarke.* *Stenosiphonium zeylanicum.* 225.
var. integer, *Clarke.* Var. *β.* 226.
S. Gardnerianus, *T. And.* 226.
S. vestitus, *Nees.* 228.
S. Hookeri, *Nees.* 227.
S. calycinus, *T. And.* 227.
var. parvifolius, *Clarke.*
S. laxus, *T. And.* 228.
S. zeylanicus, *T. And.* 227.
S. sexennis, *Nees.* *S. cerinthoides.* 229.
var. hirsutissimus, *T. And.* 229.
S. helicoides, *T. And.* 229.
S. paniculatus, *T. And.* *S. rubicundus.* 229.
S. pulcherrimus, *T. And.* 229.

587. Blepharis boerhaaviæfolia, *Pers.* 231.
B. molluginifolia, *Pers.* 231.
Sámadána, S.

588. Acanthus ilicifolius, *L.* 232.
Ikili, Kaṭu-ikili, S.
var. integrifolius, *T. And.* 232.

589. Barleria Prionitis, *L.* 230.
Kaṭu-karanḍu, S.
[B. buxifolia, *L.*]
B. mysorensis, *Roth.* *B. bispinosa.* 230.
B. noctiflora *L. f.* ("Rottler.")
B. involucrata, *Nees.* *B. pentandra* (part). 230.
B. vestita, *T. And.* 230.
B. Arnottiana, *Nees.* 230.
var. pentandra, *Arn.* (sp.) *B. pentandra* (part). 230.
(B. cristata, *L.* (*non Lam.*)) 230.
B. nutans, *Nees.* 230.
B. nitida, *Nees.* 443.

590. Crossandra undulæfolia, *Salisb.* *C. infundibuliformis.* 231.
var. axillaris, *Nees.* (sp.)

591. Asystasia coromandeliana, *Nees* (*non Wight.*) *A. gangetica.* 235.
Puruk, S.
A. chelonioides, *Nees.* 236.
A. quadrangularis, (*Heyne in Fl. Brit. Ind.*) *A. chelonioides* (part). C. P. 552.
592. Eranthemum malabaricum, *Clarke.* *E. crenulatum.* 235.
593. Andrographis paniculata, *Nees.* 232.
Hín-biṉ-kohomba, S. *Nila-vémpu*, T.
A. alata, *Nees.* 232.
A. macrobotrys, *Nees.* 232.
var. PARVIFOLIA, *Clarke.* *A. zeylanica.* 232.
A. echioides, *Nees.* 232.
594. GYMNOSTACHYUM ZEYLANICUM, *Arn. & Nees.* 232.
G. THWAITESII, *T. And.* 232.
G. PANICULATUM, *T. And.* 232.
G. SANGUINOLENTUM, *T. And.* 232.
G. HIRSUTUM, *T. And.* 233.
595. Lepidagathis hyalina, *Nees*, var. LOPHOSTACHYOIDES, *Nees.* 231.
L. fasciculata, *Nees.* 231.
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L. WALKERIANA, *Nees.* 231.
596. Monothecium aristatum, *T. And.* 234.
597. Justicia Betonica, *L.* 233.
Sudu-puruk, S.
J. ZEYLANICA, *T. And.* 233. (C. P. 2718 = 2422 part, C. P. 713 part.)
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var. capitata, *T. And.* C. P. 3919.
J. tranquebarensis, *L. f.* 233.
* J. Gendurussa, *L. f.* 233.
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J. HOOKERIANA, *T. And.* 233.
J. glabra, *Koen.* 234. (C. P. 3110 = 2422 part, C. P. 3663 = 713 part.)
? J. Monetiana, *Vahl.*
J. ROYENIANA, *Clarke.* *Rostellularia.* 234.
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J. procumbens, *L.* *R. Royeniana* (part). 234.
Mani, S.

598. Adhatoda Vasica, *Nees*. *Justicia adhatoda.* 233.
Agaládára, S. *A'dátódai*, T.
599. Rhinacanthus communis, *Nees.* 234.
Anitta, S.
? Dianthera dichotoma, *Clarke.* ("C. P. 2718.")
600. PTYSSIGLOTTIS RADICOSA, *T. And.* 235.
601. Ecbolium Linneanum, *Kurz. Eranthemum Ecbolium.* 235.
var. lætevirens, *Vahl.* (sp.)
(Graptophyllum hortense, *Nees.*)
602. Rungia longifolia, *Nees.* 235.
Sulu-neyi, S.
R. apiculata, *Bedd.* *R. repens* (part). (C. P. 1973.)
R. repens, *Nees.* 235.
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603. Dicliptera zeylanica, *Nees.* *D. bivalvis.* 235.
604. Peristrophe tinctoria, *Nees.* ("Walker.") 234.
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99. Verbenaceæ.

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* L. mixta, *L.* (L. Camara, *L.*) 242.
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607. Bouchea hyderabadensis, *Walp.* 241.
608. † Stachytarpheta indica, *Vahl.* 241.
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var. * jamaicensis, *Vahl.* (sp.)
(S. mutabilis, *Vahl.*)
609. Priva leptostachya, *Juss.*
610. Callicarpa lanata, *L.* *C. Wallichiana.* 243.
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611. PREMNA PURPURASCENS, *Thw.* 242.
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612. Gmelina asiatica, *L.* 244.
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622. PLECTRANTHUS CAPILLIPES, *Benth.* 237.
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P. Coetsa, *Don.* 237.
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623. Coleus barbatus, *Benth.* 238.
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627. Mentha javanica, *Bl.* *M. arvensis.* 239.
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* M. sylvestris, *L.*, var. crispa, *Benth.* (C. P. 2891.)
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* P. lanceolata, *L.* (C. P. 2247.) 245.

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* Mirabilis Jalapa, *L.* *Sendrika*, S. *Marvel of Peru.*
635. Boerhaavia diffusa, *L.* 245.
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636. Pisonia aculeata, 245.

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* A. paniculatus, *L.* *A. frumentaceus.* 247.
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* C. opulifolium, *Schrad.*
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649. Atriplex repens, *Roth.* 246.
650. Arthrocnemum indicum, *Moq.* 246.
651. Salicornia brachiata, *Roxb.* 443.
652. Suæda nudiflora, *Moq.* 246.
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653. Basella alba, *L.*
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* Rivina humilis, *L.* *R. lævis.* 250. (C. P. 1899.)

* Mohlana nemoralis, *Mart.*
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105. Polygonaceæ.

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* Rumex obtusifolius, *L.*
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655. TERNIOLA ZEYLANICA, *Tul.* *Dalzellia.* 223.
656. Podostemon olivaceum, *Gardn.* *Hydrobryum.* 223.
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P. ELONGATUM, *Gardn.* *Dicræa.* 222.
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107. Nepenthaceæ.

657. NEPENTHES DISTILLATORIA, *L.* 290.
Bándurá-wẹl, S.

108. Aristolochiaceæ.

658. Bragantia Wallichii, *Br.* 291.
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660. * Piper Chawya, *Ham.* *Chavica Chuvya.* 428 and 292.
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P. arborescens, *Roxb.* (C. P. 2461.) 293.
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P. TRINEURON, *Miq.* ("Walker.")
P. bantamense, *Bl.* *P. arborescens* (part. C. P. 35.) 293.
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P. nigrum, *L.* 292.
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P. subpeltatum, *Willd.* *Pothomorphe.* 292.
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P. Wightiana, *Miq.* C. P. 3954.
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110. Chloranthaceæ.

662. Chloranthus brachystachys, *Bl.* 293.

111. Myristicaceæ.

663. MYRISTICA LAURIFOLIA, *Hk. f. & Th.* 11.
Malaboda, S.
var. zeylanica, *Thw.* 11 & 399.
M. HORSFIELDIA, *Bl.* 11.
Ruk, S.
M. Irya, *Gaertn.* 11.
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112. Monimiaceæ.

664. HORTONIA FLORIBUNDA, *Wight.* 11.
Wáwiya, S.
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665. Cryptocarya Wightiana, *Thw.* 254.
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666. BEILSCHMIEDIA ZEYLANICA. *Apollonias.* 253.
667. Cinnamomum zeylanicum, *Bl.* 252 and C. P. 4000.
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668. Machilus glaucescens, *Wight*, var. ZEYLANICA, *Meissn.*
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669. Persea semecarpifolia *(Nees)*, var. ANGUSTIFOLIA, *Meissn.*
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L. AMBIGUA, *Meissn.* (C. P. 72, 2280.) *L. zeylanica*, var. 257.
L. GARDNERI, *(Thw.)* (Includes *Tetr. zeylanica*, Meissn.) 255.
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L. OVALIFOLIA, *(Wight.)* 256.
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672. LINDERA LANCIFOLIA, *(Thw.)* *Daphnidium.* 257.

673. Cassytha filiformis, *L.* 258.
C. capillaris, *Meissn.* C. P. 3982.

674. Hernandia peltata, *Meissn.* *H. Sonora.* 258.
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675. HELICIA ZEYLANICA, *Gardn.* 250.

115. Thymelæaceæ.

676. Wikstrœmia virgata, *Meisn.* 250.

677. Lasiosiphon eriocephalus, *Decne.* 250.
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678. PHALERIA CAULIFLORA, (*Thw.*) *Drymispermum.* 251.
679. GYRINOPS WALLA, *Gaertn.* 251.
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680. Elæagnus latifolia, *L.* 252.
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683. NOTOTHIXOS FLOCCOSUS, *Oliv.* *Viscum.* 418.
684. GINALLOA SPATHULIFOLIA, *Oliv.* *Viscum.* 136.

118. Santalaceæ.

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686. Scleropyron Wallichianum, *Arn.* *Pyrularia.* 251.
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687. Balanophora indica, *Wall.* 293.
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688. Euphorbia Atoto, *Forst.* 427.

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E. Chamæsyce, *L.?* 269.

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* E. Tirucalli, *L.* 268.
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689. Sarcococca pruniformis, *Lindl.* 290.
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690. Bridelia retusa, *Spreng.* 279.
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B. MOONII, *Thw.* 279.
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B. scandens, *Willd.* C. P. 3932.

691. CLEISTANTHUS ROBUSTUS, *Mull. Arg.* *Amanoa indica.* 428.

C. patulus, *Mull. Arg.* *A. acuminata* (in part) *&* *A. indica f. minor.* 428.

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C. PALLIDUS, *Mull. Arg.* *Amanoa.* 280.
var. subglaucus, *Thw. ms.* (sp.) C. P. 3981.

C. collina, (*Roxb.*) *Amanoa.* 280.
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692. ACTEPHILA ZEYLANICA, *Mull. Arg.* *A. neilgherrensis.* 280.

693. Agyneia bacciformis, *A. Juss.* 283.
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694. Sauropus albicans, *Bl.* *S. Gardnerianus.* 284.

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695. Phyllanthus zeylanicus, *Mull. Arg.* *Glochidion.* 285.
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P. CORIACEUS, *Mull. Arg.* *Glochidion* (part). (C.P. 342.) 285.

P. PYCNOCARPUS, *Mull. Arg.* *Gl. coriaceum* (part.) (C.P. 2529.) 285.

P. stellatus, *Retz.* *Gloch. Jussieuianum.* 285.

P. SYMPLOCOIDES, *Mull. Arg.* *Gloch. montanum.* 286.

P. LEPTOGYNUS, *Mull. Arg.* *Gloch. Gardneri.* 286.

P. NEMORALIS, *Mull. Arg.* *Glochidion.* 286.

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P. polyphyllus, *Willd.* 282.

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776. Phreatia elegans, *Lindl.* 299.

777. Pachystoma speciosum, *Rchb. f.* *Ipsea.* 301.
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778. Acanthephippium bicolor, *Lindl.* 307.

779. Phaius bicolor, *Lindl.* 300.
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780. Tainia bicornis, (*Lindl.*) *Ania.* 301.
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781. Josephia lanceolata, *Wight.* 307.

782. Cœlogyne breviscapa, *Lindl.* 300.
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784. Calanthe purpurea, *Lindl.* *C. Masuca.* 308.
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H. RHYNCHOCARPA, (*Thw.*) *Platanthera.* 310.
H. MACROSTACHYA, *Lindl.* 309.
H. DICHOPETALA, *Thw.* 309.
H. DOLICHOSTACHYA, *Thw.* 309.
H. viridiflora, *Br.* 309.
H. PTEROCARPA, *Thw.* 309.
? H. LATIFOLIA, *Lindl.* 310.
H. plantaginea, *Lindl.* 310.
H. CRINIFERA, *Lindl.* 310.
H. barbata, *Wight.* *Ate virens.* 309.
H. ACUMINATA, *Thw.* *Ate.* 309.
823. Satyrium nepalense, *D. Don.* 308.
824. Disperis zeylanica, *Trim. ms.* *D. tripetaloidea.* 311.
825. Apostasia Wallichii, *Br.* 315.

127. Scitamineæ.

826. Globba marantinoides, *Wight.* *G. bulbifera.* 315.
827. (Kaempferia Galanga, *L.*) 316.
Hinguru-piyali, S.
K. pandurata, *Roxb.* 316.
Amba-kaha, S.
† K. rotunda, *L.* 316.
Yawakenda, S.
828. Hedychium coronarium, *Koen.* 319.
Ela-mal, S.
var. flavescens, *Carey* (sp.). Var. β. 319.
H. angustifolium, *Roxb.* 319.
829. Curcuma Zerumbet, *Roxb.* 316.
Haran̥-kaha, S.
C. aromatica, *Salisb.* 316.
Dad̤a-kaha, *Wal-kaha*, S.

(C. longa, *L.*) *Kaha*, S. *Manjel*, T. *Turmeric.*
C. ALBIFLORA, *Thw.* 316.
C. OLIGANTHA, *Trim. ms.* (C. P. 3700.)
830. AMOMUM INVOLUCRATUM, (*Thw.*) *Elettaria.* 319.
A. FLORIBUNDUM, (*Thw.*) *Elettaria.* 319.
A. NEMORALE, (*Thw.*) *Elettaria.* 319.
A. echinatum, *Willd.* 316.
A. FULVICEPS, *Thw.* 317.
A. BENTHAMIANUM, *Trim. ms.* C. P. 3864.
A. PTEROCARPUM, *Thw.* 317.
A. MASTICATORIUM, *Thw.* 317.
A. ACUMINATUM, *Thw.* 317.
A. GRAMINIFOLIUM, *Thw.* 430.
A. HYPOLEUCUM, *Thw.* 318.
A. RUFESCENS, (*Thw.*) *Elettaria.* 430.
831. CYPHOSTIGMA PULCHELLUM, *Benth.* *Amomum.* 318.
832. Elettaria Cardamomum, *Maton*, var. MAJOR, *Sm.* (sp.) 318.
Ensál, S. *Ceylon Cardamom.*
833. Zingiber Zerumbet, *Rosc.* 315.
Z. Cassumunar, *Roxb.* 315.
Z. CYLINDRICUM, *Moon.* 315.
Wal-inguru, S.
Z. Wightianum, *Thw.* 315.
834. Costus speciosus, *Sm.* 320.
Tebu, S.
835. (Alpinia Galanga, *Sw.*) 319.
Kaluwála, S. *Great Galangal.*
A. Allughas, *Rosc.* 320.
Keleniya, *Alu-gas*, S.
A. nutans, *Rosc.*, var. SERICEA, *Moon.* (sp.) 320.
Rankíriya, S.
(A. calcarata, *Rosc.*) *Kaṭa-kíriya*, S. 320.
836. Clinogyne virgata, *Benth.* *Maranta.* 320.
Geṭa-oluwa, S.
837. PHRYNIUM ZEYLANICUM, *Benth.* *Maranta spicata.* 320.
Hulan-kíriya, S.
P. capitatum, *Willd.* 320.
Ẹt-bẹmi-kíriya, S.
838. Canna indica, *L.* 320.
But-saraṇa, S. *Indian Shot.*
839. Musa paradisiaca, *L.* 321.
Wal-kehel, S. *Wild Plantain.*

128. Hæmodoraceæ.

840. Ophiopogon intermedius, *Don.* 339.
841. Sanseviera zeylanica, *Willd.* 338.
Niyanda, S. *Maral*, T.

129. Amaryllideæ.

842. Curculigo orchioides, *Gaertn.* 324.
Hín-bin-tal, S.
C. Finlaysoniana, *Wall.* *Hypoxis trichocarpa.* 323.
Má-bin-tal, S.
var. linearifolia, *Thw.* 323.
(C. recurvata, *Dryand.*) 324. *Waya-pol*, S.
843. Crinum asiaticum, *L.* 324.
Tolabó, S. *Visha-mungil*, T.
C. zeylanicum, *L.* *C. ornatum.* 324.
Goḍa-mánil, S.
var. Herbertianum, *Wall.* (sp.) ("C. P. 3735.") 324.
C. defixum, *Gawl.* 324.
C. amœnum, *Roxb.?*
844. Pancratium zeylanicum, *L.* 324.
Wal-lúnu, S.
? P. verecundum, *Sol.*
(Hymenocallis tenuiflora, *Herb.*) *Pancratium malabaricum.* 324. (C. P. 2339.)

130. Taccaceæ.

845. Tacca pinnatifida, *Forst.* 325.

131. Dioscoreaceæ.

846. Dioscorea pentaphylla, *L.* 326.
Kaṭu-wala, S.
D. tomentosa, *Koen.* 326.
Uyala, S.
D. bulbifera, *L.* 326.
Panu-konḍol, S.
D. oppositifolia, *L.*
Hiri-tala, S.
D. INTERMEDIA, *Thw.* 326.
D. spicata, *Roth.* 326.
847. Trichopus zeylanicus, *Gaertn.* *Trichopodium.* 291.
Bim-pol, S.

132. Roxburghiaceæ.

848. Stemona tuberosa, *Lour.*, var. minor, *Thw.* *Roxburghia gloriosoides.* 432.

133. Liliaceæ.

849. Smilax ovalifolia, *Roxb.* 338.
Maha-kabarasa, S.
S. zeylanica, *L.* 338.
Hín-kabarasa, S.
S. aspera, *L.*, var. maculata, *Roxb.* (sp.) 338.
850. Asparagus falcatus, *L.* 337.
Hátá-wáriya, S.
A. gonoclados, *Baker.* C. P. 2299 (part).
[A. sarmentosus, *L.*]
A. racemosus, *Willd.* *A. sarmentosus.* 337.
var. ZEYLANICUS, *Baker.* *A. racemosus.* (part). 337.
851. Aloe vera, *L.*, var. littoralis, *Koen.* (sp.)
Kattálai, T.
852. DRACÆNA THWAITESII, *Regel.* *D. elliptica.* 338.
853. Chlorophytum laxiflorum, *Br.* *C. parviflorum.* 339.
C. Heynei, *Baker.* *C. breviscapum.* 339.
854. Dianella ensifolia, *Red.* 338.
Monara-petan, S.
855. Allium Hookeri, *Thw.* 339.
856. Dipcadi montanum, *Baker.* *Uropetalum.* 443.
857. Scilla indica, *Baker.* *Ledebouria hyacinthina.* 432.
858. Iphigenia indica, *Kunth.* 339.
859. Gloriosa superba, *L.* 339.
Niyangalá, S. *Káddinchi*, T.
860. Disporum Leschenaultianum, *Don.* 338.

134. Pontederiaceæ.

861. Monochoria hastæfolia, *Presl.* 321.
Diya-habarala, S.
M. vaginalis, *Presl.* 321.
M. plantaginea, *Kunth.* 321.

135. Xyrideæ.

862. Xyris indica, *L.* 340.
Ran-motu, *Ran-manissa*, S.
X. Walkeri, *Wight.* 340.
X. schœnoides, *Mart.* 340.
X. pauciflora, *Willd.* 340.

136. Commelinaceæ.

863. Pollia sorzogonensis, *Endl.*, var. indica, *Wt.* (sp.) *P. indica.* 323.
864. Commelina benghalensis, *L.* 321.
Diya-menériya, S.
C. clavata, *Clarke.* *C. salicifolia.* 321.
Girápalá, S.
var. attenuata, *Vahl.* (sp.) Var. *angustata.* 321.
C. persicariæfolia, *Wight.* ("Reynaud.")
C. obliqua, *Ham.* 322.
C. Kurzii, *Clarke.* *C. longifolia* (part). 322.
C. appendiculata, *Clarke.*
C. ensifolia, *Br.* *C. longifolia* (part). 322.
865. ANEILEMA GLAUCUM, *Thw.* (*in Clarke Mon.*) C. P. 3977.
A. zeylanicum, *Clarke.* *A. dimorphum & A. montanum* (part). 322.
A. esculentum, *Wall.* *A. scapiflorum.* 322.
A. dimorphum, *Dalz.* *A. scapiflorum,* var. *minus.* 322.
A. spiratum, *Br.* *A. nanum.* 322.
A. nudiflorum, *Br.* 322.
var. terminalis, *Wight.* (sp.)
A. giganteum, *Br.* *A. ensifolium.* 322.
A. vaginatum, *Br.* 322.
A. montanum, *Wight.* 322.
A. protensum, *Wall.* 322.
866. Cyanotis axillaris, *R. & S.* 323.
C. cristata, *R. & S.* 323.
C. tuberosa, *R. & S.*, var. adscendens, *Dalz.* (sp.)
C. arachnoidea, *Clarke.*
var. obtusa, *Trim. ms.*
C. pilosa *R. & S.* 323.
C. villosa, *R. & S.* *C. lanceolata* (part). 323.
C. ZEYLANICA, *Hassk.* *C. lanceolata* (part). (C. P. 3223). 323.
C. fasciculata, *R. & S.* 323.
var. Thwaitesii, *Hassk.* (sp.)
867. Floscopa scandens, *Lour.* *F. paniculata.* 323.

137. Flagellariaceæ.

868. Flagellaria indica, *L.* 340.
Goyi-wẹl, S.

869. Susum anthelminticum, *Bl.* 340.
Induru, S.

138. Juncaceæ.

870. Juncus glaucus, *Ehrh.* 340.
J. Leschenaultii, *J. Gay.* 340.

139. Palmæ.

871. † Areca Catechu, *L.* 327.
Puwak, S. *Kamuka*, T. *Areca-nut Palm.*
A. CONCINNA, *Thw.* 328.
Lén-teri, S.
872. LOXOCOCCUS RUPICOLA, *Wendl. & Dr. Ptychosperma.* 328.
Dótalu, S.
873. ONCOSPERMA FASCICULATA, *Thw.* 328.
Katu-kitul, S.
874. Caryota urens, *L.* 329.
Kitul, S. *Tippili-pana*, T.
875. Nipa fruticans, *Thunb.* 327.
Gin-pol, S.
876. PHŒNIX ZEYLANICA, *Trim. ms.* *P. sylvestris.* 329.
Indi, S.
P. pusilla, *Gaertn.*
877. † Corypha umbraculifera, *L.*
Tala, S. *Kanda-pana*, T. *Talipot Palm.*
878. Calamus longisetus, *Griff.* 330.
C. rudentum, *Lour. ?* 330.
Tudarena-wéwel, Má-wéwel, S.
C. Roxburghii, *Griff.* 330.
Wéwel, Ela-wéwel, S.
C. PACHYSTEMONUS, *Thw.* 431.
Kukula-wel, S.
C. RADIATUS, *Thw.* 431.
C. tenuis, *Roxb.* 330.
C. RIVALIS, *Thw. ms.* C. P. 3914.
Ela-wel, S.
C. DELICATULUS, *Thw.* 330 & 431.
C. OVOIDEUS, *Thw. ms.* C. P. 3925.
Tambutu-wel, S.
879. † Borassus flabelliformis, *L.* 329.
Tal, S. *Panai*, T. *Palmyra Palm.*
(Cocos nucifera, *L.*) 330.
Pol, S. *Tennai*, T. *Coco-nut Palm.*

140. Pandanaceæ.

880. Pandanus fascicularis, *Lam.* *P. odoratissimus.* 327.
Múdu-keyiyá, S. *Thálé*, T. *Screw-pine.*
P. fœtidus, *Roxb.*, var. RACEMOSUS, *Kurz.* *P. humilis.* 327.
Dunu-keyiyá, S.
P. ZEYLANICUS, *Solms.* *P. furcatus.* 327.
O'-keyiyá, S.
† P. Kaida, *Kurz.*
881. FREYCINETIA WALKERI, *Solms.* *F. radicans.* 327.
F. PYCNOPHYLLA, *Solms.* *F. angustifolia.* 327.

141. Typhaceæ.

882. Typha angustifolia, *L.* 331.
Hambu-pan, S.

142. Araceæ.

883. CRYPTOCORYNE THWAITESII, *Schott.* 334.
C. BECKETTII, *Thw. ms.* C. P. 3868.
[C. spiralis, *Fisch.*] 334.
C. WALKERI, *Schott.*
884. Lagenandra toxicaria, *Dalz.* *L. ovata.* 334.
Ketala, S.
L. INSIGNIS, *Trim. ms.*
L. LANCIFOLIA, *Thw.* 334.
Ati-udayan, S.
L. THWAITESII, *Schott.* *L. lancifolia* (part). 334.
L. KOENIGII, *Thw.* 334.
885. Pistia stratiotes, *L.* 331.
Diya-parandella, S.
886. [Arisæma curvatum, *Kunth.*] 335.
A. NEGLECTUM, *Schott.* *A. filiforme.* 335.
A. Leschenaultii, *Bl.* *A. papillosum.* 335.
Wal-kidáran, S.
A. FILICAUDATUM, *N. E. Br.* C. P. 3980.
887. Typhonium trilobatum, *Schott.* *Arum.* 334.
Panu-ala, S.
T. divaricatum, *Decaisne.* *Arum Roxburghii.* 432.
Polon-ala, S.
888. THERIOPHONUM ZEYLANICUM, *N. E. Br.* *Arum divaricatum.* 334.
889. Amorphophallus campanulatus, *Bl.* 335.
Kidáran, S.

A. dubius, *Bl.* 335.
[A. giganteus, *Bl.*]
A. zeylanicus, *Bl.* ("Koenig.") 335.
890. Synantherias sylvatica, *Schott.* *Amorphophallus zeylanicus* (part). (C. P. 3733.) 443.
891. Remusatia vivipara, *Schott.* *Colocasia.* 336.
892. Colocasia antiquorum, *Schott.* 335.
Gahala (*Kandala, Tadala, &c.*, cultivated vars.)
var. nymphæifolia, *Vent.* (sp.)
Wel-ala, Yakutala, S.
893. Alocasia cucullata, *Schott.* 336. *Colocasia.*
Panu-habarala, Nayi-habarala, S.
A. ALBA, *Schott.* ("Burmann.")
(A. indica, *Schott.*) *Rata-ala, Désa-ala*, S
A. macrorrhiza, *Schott.* 336. *Colocasia.*
Habarala, S.
A. fornicata, *Schott.* 432. *Colocasia.*
894. Raphidophora Peepla, *Schott.* *Scindapsus.* 336.
(R. pertusa, *Schott.*)
R. decursiva, *Schott.* *Scindapsus.* 336.
Dada-kehel, S.
895. Lasia spinosa, *Thw.*, var. HERMANNI, *Sch.* (sp.) 336.
Kohila, Maha-kohila, S.
896. Pothos scandens, *L.* 336.
Póṭá-weḷ, S.
var. HOOKERI, *Engler.*
P. ELLIPTICA, *Moon.* *P. remotiflora.* 337.
897 † Acorus Calamus, *L.* 337.
Wada-kaha, S.
var. terrestris, *Engl.*

143. Lemnaceæ.

898. Lemna paucicostata, *Hegelm.* *L. minor.* 331.
L. polyrhiza, *L.* 331.
899. Wolffia arrhiza, *Wimm.*

144. Triurideæ.

900. SCIAPHILA SECUNDIFLORA, *Thw.* 294.
S. ERUBESCENS, *Miers.* 294.
S. IANTHINA, *Thw.* 294.

145. Alismaceæ.

901. Alisma oligococcum, *F. Muell.* *A. glandulosum.* 332.
902. Limnophyton obtusifolium, *Miq.* *Alisma.* 332.

146. Naiadaceæ.

903. Aponogeton monostachyum, *L. f.* 333.
A. crispum, *Thunb.* 333.
Kekaṭiya, S.
904. Potamogeton indicum, *Roxb.* *P. natans.* 333.
P. pectinatum, *L.* (Inc. *Ruppia subsessilis.*) 333.
905. Naias graminea, *Del.* C. P. 3887.
906. ? Cymodocea ciliata, *Ehrenb.*
? C. serrulata, *Asch. & Magn.*
C. isoetifolia, *Asch.* *C. æquorea.* 333.
C. (Halodule) australis, *(Miq.)*

147. Eriocauloneæ.

907. Eriocaulon setaceum, *L.* 341.
E. Wallichianum, *Mart.* 341.
E. sexangulare, *L.* 341.
E. truncatum, *Ham.* 341.
E. Brownianum, *Mart.* 341.
E. quinquangulare, *L.* 341.
Kok-moṭa, S.
var. argenteum, *Mart.* (sp.) 341.
E. luzulæfolium, *Mart.* 341.
E. Wightianum, *Mart.* 341.
E. cristatum, *Mart.* 341.
E. atratum, *Koen.* 341.
var. major, *Thw.* 341.
E. FLUVIATILE, *Trim. ms.* (C. P. 3057 ?)

148. Cyperaceæ.

908. Cyperus cephalotes, *Vahl.* *C. Hookerianus.* 342.
C. stramineus, *Nees.* 432.
C. pumilus, *L.* *(non Nees.)* *C. pulvinatus.* 342.
Gó-hiri-paṉ, S.
C. hyalinus, *Vahl.* *C. pumilus.* 432.
C. globosus, *All.*, var. nilagirica, *Hochst.* *C. flavescens.* 342.
C. polystachyus, *Rottb.* 342.
var. laxiflorus, *Benth.*
C. Eragrostis, *Vahl.* *C. sanguinolentus.* 342.
C. puncticulatus, *Vahl.* 342 & C. P. 4018.
C. alopecuroides, *Rottb.* 342.
C. pygmæus, *Rottb.* C. P. 3947.

C. castaneus, *Willd.* 343.
C. cuspidatus, *H. B. K.* ("Beckett.") C. P. 803 (part).
C. aristatus, *Rottb.* 343.
C. squarrosus, *Rottb.* C. P. 803 (part).
C. compressus, *L.* 342.
C. lucidulus, *Klein.* *C. compressus*, var. 342.
C. arenarius, *Retz.* 342.
Múdu-kalánduru, S.
C. pachyrrhizus, *Nees.* *C. conglomeratus.* 343.
C. platystylis, *Br.* *C. pallidus.* 343.
C. Haspan, *L.* 343.
C. flavidus, *Retz.* (C. P. 805.) *C. Haspan* (part.) 343.
C. elegans, *L.* *C. nigro-viridis.* 344.
C. diffusus, *Vahl.* C. P. 3931.
C. pulcherrimus, *Willd.* *C. silhetensis.* 343.
C. difformis, *L.* 344.
C. Iria, *L.* 344.
Wel-híri, S.
C. eleusinoides, *Kunth.* *C. xanthopus.* 344.
C. nutans, *Vahl.* *C. distans*, var. *major.* 432.
C. distans, *L. f.* 344.
C. dehiscens, *Steud.* *C. Pangorei.* 344.
Hewan-pan, S.
C. pilosus, *Vahl.* 344.
C. procerus, *Rottb.* 343.
C. articulatus, *L.* 342.
C. corymbosus, *Rottb.* 344.
Gal-ehi, S.
var. Pangorei, *Rottb.* (sp.)
C. rotundus, *L.* 343.
Kalánduru, S. *Kórai*, T.
var. procerula, *Nees.* (sp.) *C. Retzii.* 343.
C. stoloniferus, *Retz.* ("Koenig.")
C. tenuiflorus, *Rottb.* C. P. 3966.
C. bulbosus, *Vahl.*
Silandi-arisi, T.
C. exaltatus, *Retz.* 343.
var. amœnus, *Clarke.* *C. venustus.* 432.
C. auricomus, *Sieb.* *C. Neesii.* 344 & C. P. 3940.
C. PLATYPHYLLUS, *R. & S.* *C. Roxburghii.* 343.
C. dilutus, *Vahl.* 344.
C. pennatus, *Lam.* 343.

C. dubius, *Rottb.* 344.
C. biglumis, *Clarke.* *C. umbellatus* (part). 345.
C. umbellatus, *Benth.* 345.
var. laxata, *Clarke.* (C. P. 817.)
var. panicea, *Rottb.* (sp.) (C. P. 2878.)
909. Kyllinga monocephala, *Rottb.* 345.
K. brevifolia, *Rottb.* 345.
K. melanosperma, *Nees.* 345.
K. cylindrica, *Nees.* 345.
K. triceps, *Rottb.* 345.
910. Heleocharis spiralis, *Br.* 352.
H. plantaginea, *Br.* 352, 434.
Boru-pan̥, S.
H. LAXIFLORUS, *Thw.* 435.
H. fistulosa, *Schult.* 351.
H. capitata, *Br.* 351.
H. ovata, *Br.* 351.
H. multicaulis, *Sm.*
H. tetraquetra, *Nees.* 351.
H. chætaria, *R. & S.* *Scirpus.* 435.
911. Fimbristylis polytrichoides, *Br.* 348.
F. nutans, *Vahl.* 348.
F. schœnoides, *Vahl.* 348.
F. acuminata, *Vahl.* 348.
F. tetragona, *Br.* *F. Arnottii.* 348.
Dara-hál-pan̥, S.
F. monostachya, *Hassk.* 347 & 434.
F. tristachya, *Thw.* 347 & 434.
F. fusca, *Nees.* *F. fulvescens.* 434.
F. cyperoides, *Br.* *F. cinnamometorum.* 434.
F. TENUIFOLIA, *Thw.* 434.
F. salbundia, *Kunth.* 349.
F. CONNECTENS, *Thw.* 349.
F. NIGRO-BRUNNEA, *Thw.* 434.
F. diphylla, *Vahl.* 348.
var. major, *Thw.* 433.
F. ovalis, *Nees.* 348.
F. ferruginea, *Vahl.* 348.
F. dichotoma, *Vahl.* *F. pallescens.* 348.
F. æstivalis, *Vahl.* C. P. 3943.
var. major (F. dichotoma, *Nees.*)
F. argentea, *Vahl.* 348.

F. miliacea, *Vahl.* 348.
Múdu-hál-pan̥, S.
F. globulosa, *Wall.* 349.
Hál-pan̥, S.
F. quinquangularis, *Kunth.* 349.
F. INSIGNIS, *Thw.* 349.
F. complanata, *Link.* 349.
F. chætorhiza, *Kunth.* 349.
F. Wightiana, *Nees.* 349.
var. congesta.
F. RETUSA, *Thw.* 349.
F. trifida, (*Nees.*) *Isolepis.* 350.
F. gracilis, (*Nees.*) *Isolepis.* 350.
F. PULCHELLA, (*Thw.*) *Isolepis.* 350.
F. barbata, *Benth.* *Isolepis.* 350.
F. dipsacea, *Benth.* *Isolepis.* 350.
912. Scirpus squarrosus, *L.* *Isolepis.* 350.
S. articulatus, *L.* *Isolepis.* 350.
Maha-gẹṭa-pan̥, S.
S. supinus, *L.* *Isolepis.* 350.
S. fluitans, *L.* *Isolepis.* 350.
S. grossus, *L.* 351.
S. pectinatus, *Roxb.* 351.
S. SUBCAPITATUS, *Thw.* 351.
S. debilis, *Pursh.* *S. juncoides.* 351.
S. mucronatus, *L.* 351.
913. Fuirena ciliaris, *Roxb.* 347.
F. glomerata, *Lam.* 347.
F. umbellata, *Rottb.* 347.
F. uncinata, *Wall.* 347.
914. Lipocarpha argentea, *Br.* 347.
L. sphacelata, *Kunth.* 347.
915. Hypolytrum latifolium, *Rich.* 346.
var. minor, *Thw.*
H. LONGIROSTRE, *Thw.* 346.
916. Mapania zeylanica, (*Thw.*) *Pandanophyllum.* 345.
M. IMMERSA, (*Thw.*) *Pandanophyllum.* 433.
917. Scirpodendron costatum, *Kurz.* *Hypolytrum.* 346.
918. Lepironia mucronata, *Rich.* 346.
Ẹṭa-pan̥, S.
919. Remirea maritima, *Aubl.*, var. pedunculata, *Br.* (sp.) 345.

920. ACTINOSCHŒNUS FILIFORMIS, *Benth.* *Arthrostylis.* 352.
921. Rhynchospora Wallichiana, *Kunth.* 352.
R. aurea, *Vahl.* 352.
R. zeylanica, *Kunth.* 352.
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952. Apocopis Wightii, *Nees.* 365.

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958. Ischæmum muticum, *L.* 364.

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1027. Allantodia javanica, *Bedd.* *A. Brunoniana.* 385.

1028. Actiniopteris dichotoma, *Bedd.* *A. radiata.* 386.

1029. Polystichum auriculatum, *Presl.* *Aspidium.* 389.
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JOURNAL

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OF THE

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1885.

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No. 31.

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ROYAL ASIATIC SOCIETY.

CEYLON BRANCH.

REMARKS ON THE COMPOSITION, GEOGRAPHICAL AFFINITIES, AND ORIGIN OF THE CEYLON FLORA.

[*To accompany "A Systematic Catalogue of the Flowering Plants and Ferns" of the Colony.**]

By Henry Trimen, M.B. (Lond.), F.L.S.

(Read 20th February, 1885.)

The Catalogue of Ceylon Plants which the Asiatic Society has done me the honour of accepting for publication* is in its very nature as unsuited for reading to this meeting as would be a dictionary, a concordance, or an index. It appears very fitting, however, that it should be accompanied by some general observations upon the nature, affinities, and characteristics of the interesting flora which it enumerates.

The compilation and publication of a revised list of the plants of any country always marks a new stage of progress in the knowledge of its botany. It is a sort of taking stock: its preparation requires a re-examination and comparison of

* Published as Part I. of Vol. IX. (No. 30—1885) of the Society's Journal.

I take the opportunity of supplying here two species which have by some accident dropped out of the List. The reader is requested to insert:—

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the species, the new acquisitions are worked out and duly inserted in their proper places, various errors of nomenclature get corrected, doubts are cleared up, and the whole if throughly done gives a fair *résumé* of the progress effected. In the 20 years which have elapsed since the completion of the late Dr. Thwaites's valuable "Enumeratio" much has been published bearing more or less directly upon the Ceylon flora, among which may be specially mentioned Beddome's useful illustrated works on the Botany of Southern India, and that important summary of Indian Botany, the "Flora of British India." This very extensive undertaking by Sir J. D. Hooker and numerous fellow-workers, has proceeded through more than half of the Natural Orders, and is in active progress at Kew. By this invaluable book I have, of course, been mainly guided so far as it extends—i.e., to the order *Acanthaceæ;* in the subsequent Orders, so far as Genera are concerned, I have followed the standard "Genera Plantarum" by the lamented Bentham and Sir J. D. Hooker.

In Ceylon itself, though little has been published, practical exploration and investigation have not been intermitted. My predecessor's (Dr. Thwaites) plant-collectors brought in to him from the jungle many novelties, and our few resident botanists have also been very successful in adding to the flora. Mr. T. N. Beckett, lately of Mátalé but now in New Zealand, Mr. William Ferguson, F.L.S., who lets no opportunity escape him, Mr. H. Nevill, C.C.S., a very acute observer in the field, and Mr. G. Wall, F.L.S., a keen hunter after ferns (to which group unfortunately he restricts his energies), have all contributed to swell this Catalogue of the Plants of the Island. Much of my own time since my arrival in Ceylon has also naturally been devoted to exploration, though far less than I could wish. As a result, the present Catalogue contains, I suppose, not far from 200 species additional to that of 1864, whilst the whole of the flora has undergone a critical revision, and is re-arranged according to the best available system. In the nomenclature and determinations, I have been often assisted by the botanists at Kew and at the British Museum, to whom my thanks are due. Even with this I am fully aware that not a few errors will be detected by botanists working with access to type specimens,

large herbaria, and full libraries: without these advantages it is often impossible to come to decision on doubtful points.*

The list contains about 3,250 species, of which the odd 250 may be reckoned to consist of the ferns and their allies, and the remaining 3,000 of the Phanerogams or Flowering Plants. In the remarks and comparisons which I now proceed to make, it is in general these latter—the Phanerogams—only that are taken into consideration.

2. Now the first thing to be observed with regard to these 3,000 species is that a very considerable number of them are no more natives of Ceylon than are the great majority of the Members of this Society. Like them they are aliens, settled colonists or denizens, or casual waifs and strays from other lands. This fact is always rather a surprize to those who see the vegetation of this country for the first time; for many of the plants which seem to them most characteristic really come under the category of foreigners. Such familiar trees as the Cashew Nut, the Mango, the Guava, the Country Almond (*Terminalia Catappa*), the Blimbing, the Papaw, and even the Horse-radish tree (*Moringa*), the Jak, and the Tamarind, are all of exotic origin, and introduced by man. Many of them are, no doubt, very ancient introductions, and from no greater distances than the adjacent Indian Peninsula, as the Jak, or the Malay Peninsula, as the Arecanut Palm; but many were brought from the W. Indies or Tropical America, much more recently. So, too, with the common garden plants and weeds which line our roadsides and cover waste ground; the *Opuntia* or Cactus, the Sensitive plant (*Mimosa pudica*), the yellow *Turnera*, the Castor-oil plant, the Marvel of Peru, the blue Vervain (*Stachytarpheta*), the white yellow or orange *Thunbergia alata*, the great white Trumpet-flower (*Datura suaveolens*), the pink or white *Vinca*, the Temple Tree (*Plumeria acutifolia*), the Allamanda, and many others; not to mention the too familiar *Lantana* and the nearly as abundant and much handsomer "Sun-flower" (*Tithonia diversifolia*). All

* Notes on the more important of the additions, and descriptions of the new species, will be found in my paper published in the "Journal of Botany" for 1885, commencing in the May number (p. 138).

are foreigners, and by far the greater number are from the New World, and therefore comparatively lately introduced, i.e. within the last three centuries.

This invasion of the Eastern Tropics by an army of herbaceous or half-shrubby weeds from the W. Indies is a remarkable fact.* It has had the effect of causing a very uniform character in the vegetation of the cultivated coast regions of the whole tropical belt, and it would not now be possible in many cases to even guess the origin of many species from their present distribution ; generally, however, their origin and history can be traced without much difficulty through the botanical treatises of the 16th and 17th centuries.†

Some of these plants, however, appear to inhabit naturally all the three tropical areas of Africa, Asia, and America, these are mostly such as are capable of having been transported by ordinary natural means of dispersion in past times.

3. In temperate zones the opposite state of things has held good, and the interchange of such plants between Europe and N. America has been all in favour of the Old World. English weeds have largely established themselves in the United States, &c., whilst few, very few N. American ones have succeeded in getting a permanent footing in Europe, those which have done so being a few annual species exceptionally provided with means for copious dispersion of seed, or aquatics. The same readily colonizing English weeds have also spread themselves over the cool mountain districts of the East, and as regards Ceylon a fair proportion of our introduced plants belong to this category. These, of course, are found chiefly about

* It is the clearing of land for cultivation that gives these alien plants their opportunity. A country naturally covered with forest has no native species able to compete with these foreign inhabitants of open country and plains, which, when once introduced, are thus able to spread without hindrance.

† The rapidity with which some useful or ornamental species were transported from the New World to the Old is very striking. The Portuguese came first to Java in 1496, four years after the discovery of America; and in 1520 Magellan sailed direct from S. America to the Philippines. It was from these islands that the other Eastern tropics obtained many of the American plants now so abundant.

Nuwara Eliya, and have all been imported within the last 50 years, mostly with grass seed. The great Mullein (*Verbascum Thapsus*) now looks as thoroughly native as the tall *Lobelia excelsa* along with which it grows, and in several respects resembles; and such homely plants as the Chickweed, the Spurrey, the narrow-leaved Plantain (*Plantago lanceolata*), the Dutch clover, the Dock (*Rumex obtusifolius*), and the Yarrow, have quite established themselves as factors in the roadside vegetation.

Thus we have two very distinct classes of exotic naturalized plants in Ceylon, tropical and temperate; to which may perhaps be added a third intermediate one, comprehending the weeds of the Coffee and other estates in the hills, which are principally annual wide-spread *Compositæ* of uncertain origin, and occur in vast abundance; as the White weed (*Ageratum conyzoides*), *Gnaphalium indicum* (absurdly called in some places "Wild Mignonette"), *Erigeron linifolius*, and others.

The whole number of the various sorts of foreigners sufficiently well established to find a place in this Catalogue is, including those commonly cultivated and often appearing as if wild, no less than 194. After clearing these out of the way we find 2,729 Phanerogamic Plants remaining, and it is with this, the truly native flora, that we are now concerned.*

4. Considering the variety of aspect, climate, and elevation of this tropical island and its notoriously luxuriant vegetation, it might be expected to contain a larger number of species than that above given, and indeed before the flora had been well worked out a very much larger estimate was formed. Thus, Gardner in 1845 thought there would prove to be between 4,000 and 5,000 species in Ceylon, but it must be remembered that estimates of this sort greatly depend on the individual botanist's views as to specific limitations. Perhaps that number of Ceylon "species" has actually been *described* in books, but many are here considered as varieties. And I ought to say that the course followed here

* A suspicion of artificial introduction attaches to a few also of these—such are marked in the Catalogue by a †—whilst the certainly introduced and naturalized ones have * prefixed, and those half wild from cultivation are in ( ).

in this matter is a mean between "splitting" and "lumping;" such as is kept up with more or less consistency in the "Flora of British India," and the other Colonial Floras issued by the Kew botanists: it is at least convenient to be in accord with these for the sake of comparisons.

Let us then now compare in this respect of numbers, our flora with that of a few other countries. An island area near in size (about one-sixth larger) to Ceylon is Ireland (32,524 square miles). This lies in a cool temperate, very equable climate, uniformly humid, and with no great elevations of surface; the Phanerogamic flora is very poor in species, 972, and even this estimate would be somewhat reduced if the specific limits were drawn as broadly as in this Catalogue. At the Antipodes, New Zealand presents us with another but totally different temperate flora. Though the area of these islands nearly equals Great Britain and Ireland combined, only 935 species of Flowering Plants are recorded in the latest published Flora. It must not be supposed that temperate regions are less rich in species than tropical ones; on the contrary, the richest floras of the world in point of numerical strength of species are those of the Cape of Good Hope and West Australia, both in the South temperate zone.

When we attempt to compare Ceylon with other *tropical* regions, the difficulty meets us that there is scarcely any definite area of which the flora has as yet been so thoroughly worked out. We may take, however, that of the oceanic island of Mauritius, which is well-known, and is still very rich, though it is believed that many species have quite recently become extinct. This isolated island, however, is only 850 square miles in area; it possesses 1,058 native species. The flora of the great Philippine Archipelago (the collective area of which is 53,299 square miles, or more than double that of Ceylon) has been recently estimated at 3,466 species of Flowering Plants, and the vegetation is as yet but partially known. This shows a very rich flora, no doubt. A comparison of greater interest would be with the vast equatorial island lying to the south-east of us, Sumatra, which possesses a very similar climate to our own; but too little is accurately known to render this possible. A Flora published in 1860 gives the number of known species at

2,642, which must be much below the actual number. Thus then, when it is remembered that Ceylon is situated in that part of the Oriental area—the *Indian*—which is poorest in species, its total of native plants—including Ferns, &c., nearly 3,000 species—shows decided richness, and is probably greater than that of any part of Peninsular India of the same area.

5. In one of his admirable Presidential addresses to the Linnean Society of London, the late Mr. Bentham, remarking on the fact that no Flora of a tropical country of large extent had yet been completed, added, with regard to Thwaites's enumeration of the plants of Ceylon—then (in 1869) lately published, and the only completed Flora of any tropical region—that the chief interest of this isolated district "would lie in the comparison of its very rich vegetation "with that of other portions of the Tropical Asiatic flora, "which," he added, "has not yet been made." In the following remarks I purpose to make some progress towards such a comparison, though I have not at present the opportunity or the leisure to do so in detail, or as fully as the subject requires. Let us then endeavour to ascertain the elements of which our flora consists.

The most interesting portion of the vegetation of any country, and especially of islands, is that composed of the plants peculiar to it and not found elsewhere, or as it is called *endemic*. The proportion of such species is found to vary remarkably in different places, and on this to a chief extent the individuality and interest of any flora depends. In the British Isles, among over 1,400 native species there is probably not one which is peculiar or endemic, though four or five strongly marked local varieties are considered specifically distinct by some British botanists. As a contrast, in New Zealand more than 72 per cent. of the species found there are found nowhere else. Between such extremes there is every gradation. It has long been observed that oceanic islands—that is *small* islands (usually volcanic) widely isolated from continents in the deep ocean—possess a large proportion of endemic species. Thus in Mauritius (including Seychelles and Rodriguez) 29 per cent. are peculiar, and 22 per cent. more do not extend beyond the other Mascarene

Islands. In that little speck of land in mid ocean, St. Helena, nearly 78 per cent. of the small remnant of its once remarkable flora (i.e., 53 species out of 68) are found nowhere else in the world. Of greater interest and significance is it when *Genera,* and not merely species, are endemic; this, of course, indicates a still further specialization, and here oceanic islands are particularly remarkable. Thus in Mauritius 11 per cent. of the genera are peculiar, and in St. Helena a still larger proportion.

Now Ceylon, though an island, is by no means an oceanic one; rather it is what is termed a *continental* island, being separated from the adjacent continent by the very shallow and narrow piece of sea in Palk Straits. Yet the remarkable fact presents itself that while in Britain probably not a single species is peculiar, here in Ceylon no less than about 800, or more than 29 per cent. of the Phanerogams, are strictly endemic to the island. Indeed, to these would be added by many botanists some 50 more well-marked insular sub-species or varieties of continental species, which would raise the proportion to over 31 per cent.* We do not possess many endemic *genera,* however—only about 20, or little over 2 per cent.—but here also may be added, as of similar significance, some groups peculiar to the island which are here ranked as sub-genera only.

How are we to account for this large element of specialization in our flora?

6. The opinions and theories now generally held by naturalists to explain the present distribution of animals and plants over the globe have been expressed and explained in the writings of E. Forbes, Darwin, Bentham, Wallace, J. Hooker, and others. I may remind you of some leading points. Widely distributed as are some species over the world, it is held that each has spread from some single centre where it had its origin, and in cases where a species now exists, not over an unbroken area, but at two or more spots not continuous, and even it may be widely separated from one another, it is considered (when there is no evidence of transport by men or animals) either that these points

* This is perhaps a larger endemic proportion than is possessed by any other continental island with the exception of Madagascar.

were formerly in connection, or more often that each of them has been in connection with some common point of origin in the past. Thus, the floras of continental islands have, as a basis, the plants of the mainland. All but the whole of the English species are also European (the two exceptions being American), and it is reasonable to suppose that their passage was effected at a time or times when the land was in part continuous. The English Channel is nowhere over 100 fathoms deep, and in most places not half that depth. So too in Ceylon; *after deducting the endemic ones*, we have left about 1,929 species, all of which except about 130* are also found in the adjacent Peninsula of India. No doubt the separation of the northern portion of Ceylon from the opposite mainland is geologically recent, and the species crossed over hither before it occurred.

When, however, the localities in which a particular species or group is found are widely separated (i.e., its area is *discontinuous*) we have to assume often great changes of level, producing, in present continental areas, various and different arrangements of sea and land at different periods, and also extreme changes of climate. For the operation of these is required also a vast extent of time, but the revelations of pulæontology and physical geology fully warrant the botanist as well as geologist in forming such speculations.

It frequently happens that the floras of two districts show their affinity not by identity of species, but, less intimately, by community of *genera* only, the *species* being different. A good example is found in comparing our mountain district with that of Southern India, say in both cases the flora of the hills above 5,000 feet. A large, varied, and beautiful vegetation characterizes both these regions, and they are evidently very similar. Less than 400 miles separates the summits of Pidurutalágala and Doḍabeṭta (and there are half-way houses in the Pulnis and Anamalais). Yet the curious fact presents itself that more than half the species of our hills are not found in the Nilgiris or other hills of the Indian Peninsula, but are endemic here, and probably an even larger proportion of Nilgiri species do not extend to us. The number common to both ranges is only about

* This estimate is an approximation only.

200. Yet very nearly all belong to the same genera, which are almost identical for both regions. It is thus possible to make the contradictory assertions that the floras are very similar and very different.

Let us take some illustrative examples. Of the genus *Strobilanthes*, consisting of the well-known "Nillus," the Ceylon hills possess 22 peculiar species, and the Nilgiris, &c., about 29, whilst only 2 are found in both regions; of the mountain species of Balsam, genus *Impatiens*, there are also 2 species common to both ranges, whilst Ceylon has 10 others endemic, and the Nilgiris 30; and other examples could be easily given.

These representative species of one genus in different areas were a great puzzle to naturalists until the derivative theory of the origin of species became generally accepted, when it became evident that scientific "affinity" really meant relationship by descent. If we suppose a common origin for both these Hill-floras in the past, or derive the Ceylon one from the Peninsular, the differences now seen in the two districts indicate a sufficient lapse of time since their separation to allow of the evolution under different surroundings of new forms of the rank of species, but not of the superior rank of genera. In the case in question the energy with which this differentiation of specific forms has gone on is highly remarkable.

There are cases where the relationship of distinct floras is less intimate still, where it is traceable only in the larger groups (of genera) called *Natural Orders*. The two richest and most specialized floras in the world, as already noticed, are those of the Cape and Australia; probably, scarcely a single genus is common to them, yet the large and well-marked Natural Orders *Proteaceæ* and *Restiaceæ* are abundant in each of these far distant regions, and are almost confined entirely to them. This, according to present views, implies a common focus of origin in a remote past.

7. To return to the Ceylon flora. Of our *endemic species* the great mass, fully five-sixths,* belong, as would be

* The numbers given in this paragraph must not be regarded as more than fairly close approximations. I am not able to make the investigations here which are necessary to ensure close accuracy.

expected from what has just been said as to the Hill-flora, to *genera* which are more numerously represented on the opposite continent, whence our flora was for the most part derived. As to the remaining species, there are of course those (48) which go to make up our endemic *genera*, and there are others (about 73) which are members—usually solitary and isolated ones—of genera which, though not endemic here, yet have no representatives in Peninsular India. Such *non-Peninsular* genera are also represented in Ceylon, not by endemic species, but by discontinuous ones identical with those in other countries than India (about 35). These few (108) non-Peninsular species belong to almost as many (86) genera, very many more indeed than I had expected to find before making this comparison. It is, indeed, a very striking fact that this little island, so closely connected with the peninsula of India, should possess over 100 genera of Phanerogams (i.e., over 11 per cent.) which are not found on the mainland, and of which only 20 are endemic.*

We will first examine our comparatively few endemic genera. They are, counting in two sub-genera, 21 in number, as follows :—

Schumacheria (Dilleniaceæ) sp. 3. Straggling shrubs.
Trichadenia (Bixaceæ) Monotypic. A large tree.
Doona (Dipterocarpaceæ) sp. 11. Large timber trees.
Monoporandra (id.) sp. 2. Trees.
Stemonoporus (*Vateriæ* sect.) (id.) sp. 13. Large trees.
Julostylis (Malvaceæ) Monotypic. Tree.
Pityranthe (Tiliaceæ) Monotypic. Tree.
Scutinanthe (*Canarii* sect.) (Burseraceæ) Monotypic. Large tree.
Pseudocarapa (Meliaceæ) Monotypic. Large tree.
Gleniea (Sapindaceæ) Monotypic. Tree.
Pericopsis (Leguminosæ) Monotypic. Large tree (Nédun, Sinh.)
Leucocodon (Rubiaceæ) Monotypic. Climbing shrub.
Schizostigma (id.) Monotypic. Herbaceous perennial.
Nargedia (id.) Monotypic. Shrub.
Scyphostachys (id.) sp. 2. Shrubs.
Championia (Gesneraceæ) Monotypic. Herbaceous perennial.
Hortonia (Monimiaceæ) sp. 2. Large shrubs.

* One of the endemic genera, *Hortonia* belongs to a *Family*, the *Monimiaceæ*, of which no member occurs in India proper.

Mischodon (Euphorbiaceæ) Monotypic. Tree. (Tammana Siṇh.)
Podadenia (id.) Monotypic. Large tree.
Cyphostigma (Scitamineæ) Monotypic. Herbaceous perennial.
Loxococcus (Palmæ) Monotypic. Small Palm.

One or two species of *Stemonoporus* are mountain plants; the remainder are all from the low country, and with the exception of three monotypic genera—*Pityranthe*, *Gleniea*, and *Mischodon*—which are found in the dry north and east, the whole are natives of the damp luxuriant districts in the south-western quarter of our island.

Next as to the non-endemic but yet non-Peninsular genera. The following is a list of them :—*

With species endemic.—56.

Wormia (1), Xylopia (3), Erythrospermum (1), Aberia (1), Kayea (1), Adinandra (1), Dipterocarpus (5), Sunaptea (2), Dicellostyles (1), Campnosperma (1), Ellipanthus (1), Dialium (1), Crudia (1), Agrimonia (1), Poterium (1), Anisophyllea (1), Axinandra (1), Osmelia (1), Melothria (1), Allœophania (1), Urophyllum (2), Dichilanthe (1), Prismatomeris (1), Willughbeia (1), Alyxia (1), Baissea (1), Gaertnera (4, one non-endemic), Chirita (3), Ptyssiglottis (1), Glossocarya (1), Nepenthes (1), Lindera (1), Phaleria (1), Gyrinops (1), Notothixos (1), Ginalloa (1), Trigonostemon (2), Chætocarpus (2), Allæanthus (1), Acanthephippium (1), Phajus (2), Tæniophyllum (1), Mystacidium (1), ? Hetæria (1), Aphyllorchis (1), ? Dracæna (1), Oncosperma (1), Freycinetia (2), Sciaphila (3), ? Hypolytrum (2, one non-endemic), Mapania (2, one non-endemic), Tricostularia (1), Cladium (1), ? Eriachne (1), Gymnopogon (1).

With species non-endemic.—31.

Delima (1), Anaxagorea (1), Limacia (1), Pometia (1), Strongylodon (1), Dioclea (1), Peltophorum (1), Gynostemma (1), Rhipsalis (1), Uncaria (1), Stylidium (1), Chrysophyllum (1), Ochrosia (1), Dischidia (1), Crawfurdia (1), ? Avicennia (1), Hernandia (1), Wikstrœmia (1), Taxotrophis (1), ? Appendicula (1), ? Galeola (1), Physurus (1), Cryptostylis (1), Gastrodia (1), Susum (1), Scirpodendron (1), ? Thuarea (1), Leptaspis (2) ? Lophatherum (1), ? Streptogyne (1), Lepturus (1).

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* I am in doubt as to whether some of these may not extend into India; those marked with a ? are possibly Peninsular. The figures in brackets refer to the number of Ceylon species.

The same remark applies here that was made with regard to the endemic genera. Nearly the whole are low-country plants of the wet south-west (several being sea-shore species). There are a few mountain types among them, in *Agrimonia*, *Poterium*, *Gynostemma*, *Crawfurdia*, and *Wikstrœmia*, which are thus especially interesting as not occurring in the Nilgiris.

It is then clear that this non-Peninsular element of our Flora is mainly concentrated in the south-west part of the Island; that is, between the high mountains and that part of the coast of the Indian Ocean fairly bounded by the towns of Colombo and Mátara. Let us now endeavour to ascertain whence it was derived.

I may say at once that the affinity of the great majority of the genera in the above lists is distinctly *Malayan* as opposed to Indian. By this geographical expression, I intend to indicate that type of vegetation characteristic of the whole of the Eastern or Malay Peninsula down to Singapore; of the great Archipelago stretching from the Andamans, Nicobars, and Sumatra eastward to, but not including, New Guinea; and also that extending northwards from Burmah through Tenasserim, Silhet, and the plains of Assam up to the foot of the Eastern Himalaya, which may be termed generally East Bengal. It is to this very rich and luxuriant flora that these plants of south-west Ceylon characteristically belong, though so completely discontinuous with it.

This would be readily seen in detail if we were to examine the distribution of the genera, both endemic and non-endemic, in the three foregoing lists. Fully three-fourths of them show this affinity unmistakably. In the non-endemic ones we find in many cases identical species occurring in Ceylon and in Malacca, or Burmah, or Borneo, or over a wide range of the Malay Peninsula and islands. In other cases the species are peculiar and confined to Ceylon, whilst their congeners inhabit these Malayan regions. Further examination of our flora would show us yet other species with the same affinity, although the genera to which they belong are not wholly absent from Peninsular India, as is the case with all those above enumerated.

A few striking examples are all that can be given here.

We may take 2 or 3 Natural Orders for analysis. Of *Dilleniaceæ* we possess 6 genera and 15 species; 1 genus *Schumacheria*, with 3 species, is endemic, but allied to Malayan ones; another, *Acrotrema*, has 7 species all endemic, and one very variable (of which many more species could be manufactured). Of this genus, which may be said to have its centre in Ceylon, there is one other species in the Malay Peninsula, and another occurs in Malabar (thus just excluding the genus from the above lists of non-Indian genera). The third genus, *Wormia*, is entirely Malayan, with the exception of our single endemic species (and one in Madagascar). The fourth, *Dillenia*, is mainly also Malayan; of our 2 species, one is endemic, the other also occurs in the Indian Peninsula as well as widely through Malaya. We have but a single species each of the remaining two genera, *Delima* and *Tetracera*, both of which are identical with Malayan ones, one also reaching Malabar. Of another family, *Anonaceæ*, Ceylon contains 13 genera and 39 species, and is too extensive to go through seriatim. But two of the genera, *Xylopia* with 3 endemic species, and *Anaxagorea* with one discontinuous, are Malayan and not Indian; whilst of *Uvaria*, with 6 species, 2 are identical with Malayan ones and 2 are endemic; and *Goniothalamus* has 7 species (6 of them endemic) against only 3 in Peninsular India and 7 in Malaya. But the most remarkable example of this western extension of the Malay flora to Ceylon is seen in the Nat. Order *Dipterocarpaceæ*, which is pre-eminently characteristic of the Archipelago. This family is a large one, and destined to be largely added to as investigation of the less-known Malay islands is further carried out; its members are all forest trees, and each species appears to be somewhat restricted in its range. Thus the 24 species recorded from Sumatra (under 4 genera) are all different from the far more numerous ones from Java. In the south-west of Ceylon we have no less than 8 genera of this Order, containing 46 species (i.e., 1·7 per cent. of the Phanerogamic flora and equal to the *Myrtaceæ*). Of the genera, 2—*Monoporandra* with 2 species, and *Doona* with no less than 11 species—are strictly endemic, and so is the well-marked sub-genus of *Vateria*, *Stemonoporus*, with 13 species. Of the remaining genera, *Dipterocarpus*, with 5

endemic species, and *Sunaptea* with 2, are entirely Malayan, whilst the last four—*Vatica, Shorea, Hopea*, and *Vateria*, sect. *Hemiphractum*—are chiefly so, though each is also sparingly represented in Southern India. All the *species*, however, are endemic in Ceylon with one exception, *Vatica Roxburghiana*, the "Mendora," which is also found in many parts of the south of the Peninsula.

Before going further I must direct attention to the important fact which will now have become obvious, that this Malayan type is also present in the flora of the Indian Peninsula. It is in the hot, moist regions along the Malabar coast on the slopes of the western mountain range, and between that and the sea, that there is found a rich Forest-flora, containing numerous genera and species of great interest, some also Sinhalese, but others strictly endemic or at least not found in Ceylon, and many of which have clear Malayan relationships.* The order *Dipterocarpeæ* itself is represented by 9 or 10 species, and recently a new endemic genus of this family, *Balanocarpus*, with 2 species, has been found near Tinnevelly. Other examples may be instanced in the genera *Xanthophyllum* (also in Ceylon), *Sarcostigma, Lophopetalum, Holigarna, Pterolobium, Acrocarpus, Xylia, Antistrophe*, and *Myxopyrum*.

This Malayan element is, however, much less striking in Malabar than in Ceylon, and forms a far less important factor of its flora. Proceeding northward it rapidly runs out, and has disappeared before the latitude of Bombay.

8. We return to the question, How did this Malayan flora reach Ceylon and S.W. India? I am not aware that this has been discussed from the botanical point of view, but naturalists generally have apparently been content with the theory of Wallace proposed to explain a similar representation of certain Malay types in our *fauna*. The representation in the animal world is, however, very feeble compared with that of the flora, and the botanical facts above remarked upon were probably not fully known to the eminent

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* Recent explorations of the moist forests of Malabar, &c., have added to the Peninsular flora many plants previously thought to be peculiar to Ceylon.

zoologist quoted.* The principal Malayan affinities among animals are, I believe, found in two genera of Birds, *Phœnicophæs* and *Myrophoneum*, several genera of Longicorn Beetles, and the beautiful genus of Butterflies, *Hestia;* but I believe there is no large accumulation of such types in the south-west among the animals as among the plants of Ceylon.

Wallace's theory is to the effect that the shallow northern part of the Bay of Bengal has been elevated during the late Miocene and Pliocene periods,† and thus a few Malayan types were able to migrate to the Indian Peninsula, where they have been preserved only in the Nilgiris and Ceylon, where alone a suitable climate now prevails.

This would derive our Malayan plants, like the great bulk of our flora, from India. No doubt can be entertained of an ancient continuity of the south-west coasts of India and Ceylon, either directly or by their union with some intermediate or neighbouring land,‡ but the numerous cases among the plants of Ceylon where the closest affinities are seen to be with the flora of the Malay Peninsula and Archipelago, rather than with its extension into East Bengal,§ would rather lead one to endeavour to trace a former means of communication and transfer in a lower latitude, e.g., by the Andamans or Sumatra. Both districts were of course supplied from one and the same source, but it would seem more in accordance with present facts to derive the feebly

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* It is singular that in Mr. Wallace's latest and very valuable book "Island Life" (1880), he does not once allude to Ceylon or the problems it presents for solution.

At this time geologists believe Peninsular India to have been cut off as an island from the countries to the north, the Gangetic plain begin occupied by the sea.

‡ I am indebted to Captain Donnan for the information which is important and somewhat unexpected, that the sea in the Gulf of Mannar is over 1,000 fathoms deep, and perhaps as much as 1,450 fathoms, half way between Kalpiṭiya and Cape Comorin.

§ For instance, *Dichilanthe*, a very isolated genus in structure, with one species in Ceylon and one in Borneo; *Axinandra*, *Prismatomeris*, and *Allœophania*, all in the same case; *Ptyssiglottis* with a second species in Java; *Gyrinops* with a second species in the Moluccas, and many similar cases; besides the identical species to which attention has already been called.

represented Malayan element existing in Malabar from the rich one in Ceylon, rather than to trace the migration in the opposite direction. I do not, however, venture to put forward any speculations on the matter ; such should be supported by evidence, from sea-soundings, of the existence of banks or shoals indicating areas of submergence and the position of sunken lands near the Equator in the ocean intervening between Sumatra and the Maldives to the south-west of Ceylon ; and I have no such data, and am not aware that any such exist.

9. Wallace is inclined to regard the occurrence of certain endemic animals in Ceylon and in S. India—as the *Loris*, several monkeys, a genus of Rats, *Elaphrornis* among birds, the *Uropeltidæ* among snakes, and certain Lizards and Batrachians—as indicating a separate *Indo-Ceylonese* zoological sub-region. In a general sense this may be also said of the flora, but in the rich moist regions of our island—the Western Province and parts of the Central and Southern Provinces—and the Malabar coast of India, I find it difficult to clearly distinguish any peculiar element characteristic of both, apart from the Malayan one already so strongly dwelt upon. There are, however, a few endemic genera which do not present any specially Malayan affinities. Thus, *Mischodon*, a Euphorbiaceous tree valuable for its timber, the "Tammana" of the Siṇhalese, is very isolated in structure and confined to Ceylon. Three other Euphorbiaceous genera are common to both Ceylon and South India, *Ostodes*, *Adenochlæna*, and *Givotia;* in *Malvaceæ* *Julostyles* in Ceylon and *Decaschistia* in India are respectively endemic and closely allied ; and there are also a few other genera common to both parts of the Indo-Ceylon region but not occurring elsewhere, as *Kendrickia* and *Fergusonia*. All of these have no marked relationship to Malayan types, and may be perhaps evidence of the existence of a special element apart from them.

As to the flora of our dry region—fully four-fifths of the area of Ceylon, and for the most part covered with low forest composed of a very uniform and monotonous vegetation—it is the Carnatic flora essentially. This is very much more fully represented in continental India than here, though

exploration of the north and east of the Island is continually lessening the disparity. To this type a moderate number of our endemic species belong, all closely related to continental ones, and clearly derivable from them or from common ancestors. Of our endemic genera, *Gleniea,* closely related to *Sapindus* and *Nephelium,* may be referred to this element, and possibly also *Podadenia,* more slightly allied to *Mallotus* in Euphorbiaceæ.

It would at first appear that in the high Hill-flora of the two countries stronger grounds for the establishment of a separable Indo-Ceylon Floral region might be found. Yet, in spite of the great development of species to which attention has already been called, we do not find any features which mark off these hill-districts as an area of preservation of ancient or special types. There is not, I think, a single endemic genus in either district or in both combined. The Ceylon hills certainly contain a few genera not met with in the Nilgiris, as *Agrimonia, Gynostemma,* and *Crawfurdia;* and some species, as *Potentilla Mooniana, Anaphalis cinnamomea,* and *Lysimachia ramosa;* so, too, the Nilgiris have several genera wanting here, as *Fragaria, Rosa, Circæa, Passiflora, Lonicera, Carduus, Salix, Gnetum, Cypripedium,* and *Lilium;* but all of these are Himalayan, as is also, I believe without exception, every genus of these Indo-Ceylon highlands. Their flora, therefore, may be regarded as simply a southward extension of the Himalayan without any other admixture.

10. There remain now but a few anomalous factors of our Ceylon flora to be alluded to. The most interesting are a very small number which link us with Tropical Africa, or at least with Mauritius and the other Mascarene Islands.

Thus, *Erythrospermum phytolaccoides,* a beautiful evergreen tree of the south, is one of a genus of 6 species, all the others being natives of the Mascarene Islands. *Eugenia lucida* grows in the Mâtalé District, but is elsewhere known only in Mauritius and Bourbon.

A very interesting plant is *Rhipsalis Cassytha,* a common epiphyte on old trees in the Central Province, which is found also only in Mauritius and Tropical Africa and

America. This is also the only member* of the large order of *Cactaceæ*, which grows naturally outside of the American continent. A few other examples of this connection with the West might be given,† though they are very few compared with the large number which Asia has given to Mauritius. But they equally point to a means of communication, which, it appears almost certain, once permitted the passage of organisms across the Indian Ocean.‡ The hypothetical continent of "Lemuria" invented to account for the distribution of that curious group the Lemurs, of which our *Loris* is a member, has been found unnecessary in the light of palæontological discoveries, but the existence of the very extensive shoals, coral reefs, and islands which are known under the names of the Carcados, the Chagos, and the Maldives, show the former existence of a series of very large islands in the deep ocean, and bridging the distance at intervals.

The Maldives possess a special interest for us. The sunken land upon which the "12,000 isles" have been built up by the coral-makers must at the lowest computation have been 500 miles long and 100 broad; another Sumatra must then have approached close to our shores. Now, the nearest atoll is 350 miles from Cape Comorin, and 400 from Ceylon, and the wild vegetation consists merely of a few sea-shore plants brought by the waves, and some weeds of cultivation. But in the past which has made the present,

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* A second species of *Rhipsalis* has lately been found in Madagascar.

† There are also similar cases in the Peninsula in the genera *Naregamia*, *Calpurnia*, *Hardwickia*, *Droguetia*, &c.

‡ Several botanists have remarked that the main direction of the migrations of plants is from east to west, and it has been suggested that this is connected with the earth's rotation. We are also led from many considerations to the inference that the world has been originally stocked with plants from the north. Migration generally, then, when unchecked by insurmountable barriers may take an average course of from north-east to south-west. This consideration may tend to explain the fact that the great accumulations of endemic species are so often found crowded together in the south-west extremities of continental areas. The neighbourhood of Cape Town in South Africa and West Australia are striking examples; the Indo-Ceylonese flora under examination may perhaps afford another less marked one, and similar phenomena in a smaller scale are to be seen in Europe and its Islands.

the flora of Maldivia, doubtless, had its part to play in the great progressive drama of Nature. We can only guess at what it may have been, part apparently of the great bridge between Africa and Asia; but we may feel sure that this sunken land was intimately connected with the events and changes which contributed in their time to the formation of the existing flora of Ceylon.

APPENDIX.

I APPEND a few tabular statements bearing upon the composition of the Ceylon Flora, considered from a systematic point of view.

I.—*Number of Native Genera and Species.*

	Genera.	Species.
Dicotyledons	759	2,019
Monocotyledons	237	710
Phanerogams	996	2,729
Vascular Cryptogams	75	260
Total	1,071	2,989

II.—*Preponderant Natural Families.*

The following seven Orders, each containing over 4 per cent. of the species native to Ceylon, collectively comprise over two fifths of the whole Flora:—

		Number of species.	Per cent.
1.	Filices	228	7·63
2.	Leguminosæ	208	6·96
3.	Gramineæ	198	6·62
4.	Orchideæ	155	5·18
5.	Cyperaceæ	152	5·08
6.	Rubiaceæ	137	4·58
7.	Euphorbiaceæ	132	4·41

Followed by *Acanthaceæ* (95), *Compositæ* (76), *Urticaceæ* (67), *Melastomaceæ* (52), and *Dipterocarpaceæ, Myrtaceæ,* and *Convolvulaceæ*, (each 46).

The average number of species to each Natural Order in Ceylon is 18.

III.—*Preponderant Genera.*

Genera containing over 20 species are:—

1.	Cyperus ...	46	7.	Ficus	...	24
2.	Eugenia ...	40	8.	Memecylon	...	23
3.	Panicum ...	38	9.	Crotalaria	...	21
4.	Fimbristylis ...	34		Desmodium	...	21
5.	Phyllanthus ...	30		Hedyotis	...	21
6.	Strobilanthes ...	27				

The average number of species to a genus in Ceylon is 2·77.

IV.—*Endemic Species.*

The leading Natural Families (II.) which also contain a large proportion of Endemic Species, are:—

	Number of Endemic species.		Per cent.
Dipterocarpaceæ ...	45	...	97·8
Melastomaceæ ...	38	...	74·5
Myrtaceæ ...	26	...	56·5
Rubiaceæ ...	72	...	52·5
Orchideæ ...	74	...	47·7
Euphorbiaceæ ...	53	...	40·1

The average proportion of endemic species in a Nat. Order in Ceylon is 5·27 per cent., but over one-third of the Orders contain no endemic Ceylon species at all.

Leading Genera (III.) with a large proportion of endemic species are:—

	Number of Endemic species.		Per cent.
Strobilanthes ...	25	...	92·5
Memecylon ...	17	...	73·8
Hedyotis ...	15	...	71·4
Eugenia ...	25	...	62·5
Phyllanthus ...	16	...	53·3

The average to each genus is 0·76 per cent. in the whole Flora.

V.—The following Natural Orders are quite absent from the Ceylon Flora, though all possess species in some other parts of the Eastern tropics:—

Hamamelideæ, Epacrideæ, Myoporaceæ, Illecebraceæ, Cytinaceæ, Juglandeæ, Myricaceæ, Casuarineæ, Cupuliferæ, Salicaceæ, Gnetaceæ, Coniferæ, Irideæ, Philhydraceæ, Restiaceæ.

RICE CULTIVATION UNDER IRRIGATION IN CEYLON.

By E. Elliott, Esq., C.C.S.

(Read 11th August, 1885.)

For many years there has been a widely accepted idea that rice cultivation in Ceylon does not pay. A dictum of Sir C. P. Layard has been generally quoted in support of this, and two writers many years ago* published certain statistics which appeared confirmatory of this unfavourable view; and these were, I believe, allowed to pass unchallenged, though they contained errors which materially affect the result. However, whether erroneous or not, these opinions and figures referred to a time and to districts where the attempt had not then been made to provide irrigation. This fact has been overlooked in recent discussions; indeed, both writers and speakers have gone further, and have asserted that it would probably pay better to import nearly all the rice required in the Island, as it is doubtful whether Ceylon can economically compete with India in the production of paddy.

For many years past I have been unable to accept the low estimate made as to the small profit to be derived from paddy cultivation; but whatever doubts I may have had on this point have been entirely removed by my

* Mr. Ludovici's "Paddy Cultivation" and "Speculum's" letters. In "Speculum's" estimate, outlay in labour is excessive, especially for watching, reaping, threshing, and husking; while Ludovici takes too high a rate of wages—7*d*. as the value of a day's labour in a district where no agricultural labour was at the time remunerated in money. Other points in his calculation are also open to question.

observation of the effects of irrigation, where that has been provided on a satisfactory basis.

Since the question has been so prominently revived, I have taken considerable trouble to further investigate the subject; and I have been able to collect a very large and varied mass of data as to the yield of paddy, as well as to the actual outlay necessary to bring a crop to maturity, in the irrigated lands of the Mátara and Batticaloa Districts.

The results proved so far more favourable to Ceylon than I had ventured to anticipate, that when invited by the Committee of this Society to contribute a Paper, I readily accepted the opportunity for making my researches public, in the hope of being able to remove doubts which might exist as to the possibility of growing paddy in Ceylon at a cheaper rate than it can be imported from India.

In discussing this question, it is convenient first to review shortly the information available, especially as regards the superior fertility of rice land in India. I have been unable to meet with any reliable returns of the yield of grain in North India, but I recently saw it stated in the newspapers that the average crop in Burmah was 42 bushels per acre, and that 1,500 pounds weight of paddy had been harvested from an acre of land in Bengal. The latter is equal to 30 English bushels by measurement, or a return of 12-fold according to the ordinary Ceylon rate of sowing. Much reliance cannot be placed on such casual notices as indicating the regular returns from an extended area; but fortunately I have had access to the transactions of the Revenue Settlement of parts of the Madras Presidency, in which very elaborate statistics are given of the yield of various soils in the irrigated and rich districts, served by the works on the Godavery and Cavery rivers.

In these publications I find it recorded that in the Godavery delta, soil of good quality will produce, under irrigation, about two pooties of 800 seers of paddy per acre, and the next sort about one and a-half pooty. For the inferior soil about one pooty per acre may be assumed. As the pooty of paddy weighs 1,200 to 1,400 pounds, this yield is equivalent to 50, 40, and 26 bushels per acre.

In South Arcot, in the doab of the Coleroon and Vellar,

which is irrigated by the lower Coleroon anicut, it is stated that 300 experiments gave the following results :—

	Per Acre. Harris Collums.*		Per Acre. English Bushels.
Island and other alluvial deposits ...	45	=	47¾
Permanently improved lands near village	40	=	42½
Best lands with vandel or sandel† ...	35	=	38
Ordinary do. do. ...	30	=	32
Best ordinary, rich in sandel ...	40	=	42½
Good ordinary	35	=	38
Ordinary	30	=	32
Ordinary red earth	25	=	26½

Col. Baird Smith, in writing of the irrigation works on the Cavery and Coleroon, gives the average yield in the irrigated lands at 40 bushels per acre ; and in his work on Italian Irrigation expresses no surprise on learning that in the permanent rice lands of Mantua and Verona the average produce per acre was estimated at 30 to 35 bushels of uncleaned grain, while the temporary land in the same and adjoining provinces yield about one-fifth more, or 40 bushels an acre. He adds : "The process of cleaning re- "duces the rice to about one-third its bulk, so that for "permanent land the produce would be nearly 13 bushels "of rice."

In a recent Order of the Madras Government reviewing the working of the Saidapet Farm, it is recorded that in the reply given by the Director of the Revenue Settlements to the Famine Commission, the average yield per acre of rice lands in this Presidency is stated to be 1,884 pounds, and in some localities it exceeds 2,500 pounds. These figures represent 35 and 50 English bushels of paddy, and would, in the agricultural *parlance* of Ceylon, be spoken of as equivalent to a yield of 15- to 20-fold on a sowing of 2½ bushels per acre.

It must be remembered that these data are drawn from the hurried trial measurements of the Settlement Officers, and it has been recently urged that, as these results are

* One Harris collum = 24 Madras standard seers of 100 cubic inches = 1·06 English bushel.

† Fine mud deposited by the floods.

deduced from experiments on a limited scale, the tendency is to exaggerated results.

Nor must it be overlooked that there is in India a system of cultivation which is decidedly superior in many respects to that followed in this Island; and I have been also assured that in the Madras Presidency much more manuring is done than in Ceylon, though there is still room for improvement in this respect.

Turning to Ceylon, the first matter to be dealt with is the *cost of cultivation;* and on this point I am able to give very full information, the result of personal inquiry in the Mátara and Batticaloa Districts. As the details of cultivation differ in many respects in these Districts, it is necessary to give a short outline of the practice in each.

In *Mátara*, one or more cultivators jointly undertake the tillage of a field. One at least of these men has generally a proprietary interest in the land. There is no hiring of coolies or money payments for any additional requirements. The work is done on the co-operative or bee system, neighbours mutually assisting each other without any special remuneration beyond a good meal provided by the individual whose land is being tilled.

The cultivation of paddy has been so extended in the Mátara District, and the available land is so incessantly under crop (two harvests being almost invariably taken from the same land in the irrigated villages), that there is little or no grazing ground left for cattle, and the buffaloes especially have to be driven long distances*—some beyond Taṅgalla, 15 miles away—for pasturage.

In consequence of this difficulty and the abundant supply of manual labour, cattle are very little used, and the fields are almost entirely tilled with the mamotie. The soil is dug up and turned three times and then sown, and this occupies a man about 40 days for an area of an amunam, or 2½ acres.

As the cattle are folded or driven away, there is no

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* In Mátara District in 1882 the number of buffaloes was only 10,162, and in the chief irrigated Pattu, the Gaṅgaboḍa, only 1,800, or one to every 8 acres. In Batticaloa the number was 36,630 in 1882, or about 1 to every 2 acres cultivated with paddy.

fencing to be done, and watching too has been nearly given up, as all the people live in gardens bordering the fields, and there are no wild animals, such as pigs or elephants, to be guarded against.

Reaping an amunam's extent occupies a man 16 days, and threshing and winnowing about 30 days for an average good crop. Allowing a margin for contingencies, the cultivation and harvesting of an amunam of land in the irrigated villages of the Mátara District require 90 days of a man's labour, or 36 days* per acre, besides an outlay of about four bushels of paddy for seed and tools.

I may here mention that Mr. Weeracoddy, in the report of his experiment in Kẹgalla, gives 34 days per acre as his outlay in labour, inclusive of certain permanent improvements he had to undertake.

In *Batticaloa*, the arrangements for cultivation are not so simple, while the lands are more extensive, and a smaller portion of proprietors cultivate their own lands. There are two extensive harvests in each year, known as the "munmári," which may be termed the winter crop, and the "kalawellámai," or spring crop.

For the "munmári" it is usual to engage cultivators, of whom one is termed the head field servant or mullakkáran, who has certain privileges, and supervises the other three field servants (or four in all) required for an extent of ten amunams. As the long drought which prevails during the South-West monsoon hardens the ground, it is usual to wait for the light rains of September to soften the soil before beginning to plough.

The object kept in view in ploughing with the small native implement (which is similar to that used in other parts of the Island) is by frequently going over the land to thoroughly pulverize the soil. The seed is then sown broadcast without being germinated, and left to spring up by itself under the influence of the first rains, ploughing and sowing going on until stopped by the heavy rains of October. A description of paddy which takes six

* I find Ludovici in his "Rice Cultivation" estimates the labour for cultivating an acre at very nearly the same number of days.

months to mature is sown at first, and latterly one which requires four months. By this means the most is made of the time favourable to sowing, while the rush at harvest is reduced by the crop not all ripening at the same time.

Cattle are hired for ploughing, and payment made in paddy, varying (for a ten-amunam extent) from six amunams in the southern districts to four amunams in the northern, where cattle are more plentiful in proportion to the arable area.

In October and November the field servants complete the fences and repair the ridges, &c.; and, ordinarily, for three months after this they have but little to do, beyond sleeping at night in the watch-huts, though they are supposed at intervals to patrol the fences. Their days are practically free, and they can engage, if so inclined, in other occupations which will not take them too far away. As a fact, all grow plots of vegetables and tobacco on the higher portions which are to be found in every munmári land, besides shooting game, fishing, and collecting jungle products. In some localities they are able, in January, to undertake the cultivation of lands for kalawellámai, especially in the southern districts. In March the reaping begins, and the crop might be all threshed out by the end of April; but in practice it is stacked and threshed out later at leisure, to admit of the field servants taking part in the cultivation for kalawellámai now going on.

For reaping extra assistance is taken on, though not invariably, and costs from three to five amunams (for ten amunams' extent) according to the locality and the demand for labour at the time. Threshing out the crop is done entirely with buffaloes, which have generally to be hired, and this operation costs from $2\frac{1}{2}$ to 4 per cent. of the crop in kind.

Other charges, also paid in kind, are the "kuruvikkáran" or bird-boy, who is employed to frighten off the birds at the time of sowing and when the crop is in ear; also the cost of ploughs and mamoties, Vattai Vitánai's fee, &c.: these charges may be put down at two amunams for every ten amunams' extent.

The cost of cultivation of an extent of ten amunams (or

say 25 acres)* with four or six months' paddy for the "munmári" thus amounts to an outlay (including seed paddy) of about 26 amunams in grain, and the services of four men for a period of 8 months, or 960 days of a man.

The kalawellámai is sown between February and May. The paddy generally used is of a kind which ripens in three months, and is germinated before sowing. The lands cultivated for this harvest invariably lie low, and have been generally flooded during the rainy weather of the North-East monsoon. They are consequently much softer and more muddy than munmári lands, and are trampled with buffaloes (costing six amunams) and tilled with the mamotie. The proportion of field servants required is also smaller, and three can undertake an extent of ten amunams ; but, on the other hand, more additional aid is required in sowing and at harvest time; while the extra charge for reaping and threshing comes to nearly 50 per cent. more, viz., 11 amunams against 8 for munmári. Then there are the usual charges for bird-boy, tools, &c., amounting to 2½ amunams more.

The crop is reaped and threshed between June and August. The cost of cultivating ten amunams' extent, or 25 acres, for kalawellámai, amounts to an outlay of 32 amunams in paddy, and requires the labour of three field servants for 5 months, or 450 days of a man.

In this District also no money wages are paid for agricultural operations, the regular cultivators being remunerated by certain shares and perquisites out of the crop. But if additional assistance is required for any purpose, the ruling rate is a "marakal" (a quarter of a bushel) of paddy a day. At this rate the expenses of cultivation in grain would average 13 bushels per acre.

This result agrees fairly, though worked out independently, with a reply furnished to a Committee of the Legislative Council by Mr. Crowther, a Proctor and landowner at Batticaloa, in which the cost of cultivating 75 bushels,

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* In Batticaloa District it is usual, according to season, situation, &c., to sow from 2 to as much as 3¾ bushels of paddy in an area of an English acre. I have accordingly assumed 3 bushels to the acre as a fair average proportion in my calculations. This makes the amunam sowing extent the same as in the Sinhalese districts.

extent by hired coolies is given at 350 bushels in grain, or about 13 bushels per acre. In another estimate for cultivating 10 amunams in the customary manner, Mr. Crowther provides for three field servants, and an outlay of $24\frac{1}{2}$ amunams of paddy (exclusive of ground share or rent, and consumption paddy which is an advance repaid at harvest time).

From the Indian reports I find that in the Godavery District, where agricultural services are remunerated in grain, the expenses of cultivation are very nearly the same, and are given in the revenue reports as $3\frac{1}{2}$ pooties of grain for 1 pooty extent, equivalent to 100 English bushels for 8 acres, or $12\frac{1}{2}$ bushels the acre. In other parts of the Madras Presidency the rate is very much the same.

Perhaps it is as well I should explain that I have throughout dealt with the case of a proprietor working his own land with his own capital, hiring at ready money prices any additional aid he requires in men or cattle, so as to avoid liability for the exorbitant rate of interest charged for deferred payment, which, in Batticaloa, is never less than 50 per cent.

All the information which I have collected (though obtained direct from practical working agriculturists) has, owing to my official position, been afforded under the impression that it was sought with a view of increasing their liabilities to Government. We may consequently, I think, safely conclude that the figures given are very outside estimates, rarely worked up to, and include charges not always incurred. For instance, I have made no deduction for the spare time on the cultivator's hands between sowing and reaping, which a European employer of labour would doubtless find some way of turning to account. Indeed, many natives do, to my own knowledge, utilize it for other purposes, as already explained, as the only call on them during this interval is that of watching by night, which is done alternately or by arrangement, so as to admit of at least half the men being absent at a time, and frequently by the substitution of mere children.

Again, as regards harvest operations, I found, when going round, that in many instances these are done by the regular field servants, sometimes aided by their female

relatives and children (who get no additional remuneration), and no extra aid is called in unless the crop is really a heavy one, and comes in with a rush; but I have allowed the full charge in all cases.

I will now pass to consider *the quantity of paddy that can be grown on an acre* of land. But I must first point out that the yield in Ceylon is generally spoken of by "fold," and, ordinarily, without reference to the amount of seed sown, or the mode of sowing adopted. In India the seed is, I believe, invariably sown in small beds, and the plants transferred when about a month old to the prepared land in which they are to be matured. Under this system 50 to 60 pounds weight of paddy, or about an English bushel by measurement, suffices to sow an acre of land.

In Ceylon (except, perhaps, in Jaffna on a small scale) this system is not followed. The seed is sown broadcast, and in the Batticaloa District for the munmári without being previously germinated, as usual in the Siṇhalese districts. This leads, I believe, to great waste, as much as 3¾ bushels to the acre being, it is alleged, sown in some lands in Batticaloa, and nowhere less than two; while in the Siṇhalese districts it takes six bushels to sow an amunam's extent, or about 2½ bushels to the acre. A return, therefore, which might be termed one of 30-fold in India, would be equivalent to one of 12 in most parts of Ceylon, and in some parts to only 7½-fold. In examining the figures for Ceylon, therefore, it will be well for purposes of comparison to reduce the returns secured to the number of bushels of paddy per acre.

In Mannár, Baldæus speaks of a return of a 100-fold, and Mr. De Hoedt, late Head Clerk of the District Kachchéri, and a landowner and practical cultivator, assures me that in a favourable season (in the absence of proper irrigation) he has ordinarily obtained a return of 30-fold on a sowing of 3½ bushels, or over 100 bushels an acre; and that 25-fold or 87 bushels is the usual return cultivating in the ordinary native way.

In Mátara, before irrigation was introduced, in favourable localities a return of 30-fold or 75 bushels an acre was admittedly obtained; and Mr. Dawson, in his reports as Grain Commissioner, speaks of a similar return being

secured in two villages near Hikkaḍuwa. These returns are exceptional, it is admitted, under existing circumstances; but they are mentioned to show what can be, and is being, secured in Ceylon without the stimulus of improved cultivation or regular irrigation.

It cannot be too emphatically insisted that the primary consideration in regard to paddy cultivation is a regular water-supply. In its absence the best lands give but an indifferent return, and where it is present the poorest lands give, I believe, a remunerative crop. In the irrigated districts of Mátara it is now freely admitted that a crop of 30 bushels to the acre is regularly secured frequently twice a year, and in Batticaloa there is ample evidence that the return varies from 30 to 60 bushels per acre, with a most slovenly and imperfect style of cultivation, in which very little is done by man and a great deal by Nature.

I see it stated in the report of the Irrigation Committee of 1867 that the return in Ceylon was at one time 17½-fold, according to an inscription in the Polonnáruwa tablet. This, I presume, refers to lands irrigated by the tanks erected by the Siṇhalese Kings, and I have every reason to believe fairly represents the return now-a-days in the irrigated districts in the south and east of the Island. I need not here refer to the evidence on which this opinion is based, as I am content to rest my calculations as to rice cultivation on more moderate returns.

We will first take the case of a gross crop of 25 bushels of paddy to the acre, which would be spoken of as a return of 10-fold in the Siṇhalese districts, and of 7-fold in South Batticaloa, where the acre is considered as equal to 3¾ bushels' sowing extent.

Dealing first with Batticaloa, we must, from the gross return, deduct the outlay in grain for seed, ploughing, &c., already detailed, and the Government tithe. These first charges amount to 10 bushels per acre for munmári, and leave a nett outturn of 15 bushels as the return for the 38 days' labour bestowed by the cultivator in the sowing and gathering of the munmári crop, or about 2½ days' labour for the bushel of paddy.

This is an outside estimate of the most expensive cultivation I know of in Ceylon, and one, I believe, never

touched. In kalavellámai lands, in which a quicker-growing paddy is cultivated, after the usual deductions the cost falls to $1\frac{1}{2}$ day's labour to the bushel; and if a return of 30 bushels to the acre is secured, the proportion is still further reduced to 1 day's labour, while a return of 37 bushels would secure a bushel of paddy for $\frac{3}{4}$ day's labour.

In Mátara the proportion is as follows:—

For a 25-bushels' crop		$1\frac{3}{4}$	day per bushel.
30-	„	$1\frac{1}{2}$	„
37-	„	$1\frac{1}{9}$	„

As I have already stated, the expenses of cultivation have erred on the side of liberality, while the return has been taken at a moderate rate. I feel, consequently, after a very careful consideration of the whole subject, I am by no means overstating the case in venturing to affirm broadly, that in a fair land, properly irrigated, on an average *a day's labour produces a bushel of paddy.*

As I have taken a low rate of yield, I have made no special deductions for unfavourable years, attacks of insects, &c. Flood and drought are the two great enemies of paddy cultivation. The former is not hurtful unless the plants are submerged for an excessive period, fluctuating according to age and variety, and can be guarded against by selection of land and timely sowing. On the other hand, these floods do good by the fertilizing matter deposited on the lands, and in every district I have found the best lands are those liable to be inundated at frequent intervals. When irrigation is provided, it is possible to choose the proper time to put in the seed; the cultivation is practically independent of the weather to a great extent, and the danger of drought reduced to a minimum. Caterpillars and flies (or more properly speaking a description of bug) are the next most important enemies of the paddy plant. Caterpillars can generally be got rid of with a good supply of water, and the damage by flies is, I believe, limited in extent. I recently saw some fields, about which there were loud complaints, and which were said to have suffered more than had ever been experienced in that locality. Inquiry showed the yield had been reduced by about 2-fold in fields which ordinarily return 7 to 9-fold. In Madras an allowance of 15 per cent. on *the full crop of a favourable*

year is considered sufficient to cover all adverse contingencies.

I have purposely worked out my figures so far in days' labour and grain, in keeping with native modes of estimating agricultural outlay. In addressing a European audience it is necessary to attach money equivalents to these results, based on the value of labour in each locality.

In South Batticaloa the ordinary rate of pay on the cocoanut estates is 18 cents per diem, and the hire of an agricultural labourer is a marakal of paddy per diem, which generally changes hands at about the same rate. The road commutation tax in both Batticaloa and Mátara is Rs. 1·50 in lieu of six days' labour. In neither District is there any special demand for labour, except for paddy cultivation. Twenty-five cents a day is therefore an exceptional wage, and a very outside value of time in the local labour market of both Districts.

In my opinion, the most unfavourable view that can be taken of the situation is that paddy can be grown in Ceylon for 37½ cents a bushel, and that it is probable a large proportion is raised at a cost of 25 cents (sixpence) a bushel; while it can be sold nearly everywhere for at least a rupee, leaving a profit of 75 cents per bushel to meet interest on capital invested, &c.

Turning to India again for a moment, I find that the average selling price of paddy in the Madras Presidency has been 94 cents per bushel during 1881 and 1882, against 96 cents for the three years previous to the famine. To this, on grain coming to Ceylon, has to be added Customs duties amounting on both sides to 26 cents per bushel, besides freight and other charges. So that it is not surprising the price of paddy is generally Rs. 1·50 in the Jaffna market, where alone Indian grain comes into competition with the surplus production of the Batticaloa District, and that surplus comes burthened with charges for transport of over 50 per cent. on the cost of production. In the Colombo bazaar Indian paddy generally sells at Rs. 1·37½ per bushel, and the Customs valuation for statistical purposes has for some years been Rs. 1·50.

This brings me to the consideration of the cost of bringing Ceylon paddy to market. In Mátara not nearly enough

is yet grown to meet the demand of the resident population, and consequently there is a market on the spot.

In Batticaloa, on the other hand, an excess over local requirements is produced even in unfavourable years, and in 1883 over 350,000 bushels were exported to Jaffna coastwise, besides what was sent inland to Badulla and Bintẹnna, of which no account can be obtained. As Jaffna ordinarily absorbs an annual import of about 900,000 bushels of paddy, there is still a considerable margin in this market so long as Batticaloa can undersell Indian paddy, as it does now.

Batticaloa is further favoured by possessing cheap transport to this market, owing to the facilities offered by the extensive backwaters, which are such prominent features on this side of the Island; and the fortunate circumstance that both harvests fall within the period when communication with Jaffna by sea is easy and rapid. A considerable number of native vessels engage in the trade, especially during the continuance of the South-West monsoon, and paddy can consequently be transported from the threshing-floors in the fields to any seaport market in the Jaffna Peninsula for about 20 cents per bushel.

A grower of paddy in Batticaloa can therefore, in my opinion, put his paddy into the Jaffna market for about 50 cents a bushel, and secure a profit of about 75 cents a bushel—possibly a little more.

In Mátara the extent of waste land is now very small, and as there is considerable wealth in the District, fields in favourable localities fetch fancy prices, running to as much as Rs. 200 to Rs. 250 per acre.

In Batticaloa the circumstances are very different, and the supply of land is still in excess of the demand. For a limited extent situate in a central locality, an alluvial well-watered plain, known as the Karaivákuppallam, the value rivals, if it does not exceed, that for the best lands in Mátara; but the usual price for ordinary paddy land in cultivation is Rs. 30 to Rs. 50 per acre, and at this rate a large proportion of the fields could be purchased. Waste land in this District can be procured at Rs. 10 per acre and survey fees, payable in four annual instalments. As the Batticaloa lands when sold are covered with jungle, after cutting out any timber available, purchasers hand over the property for a couple of

years to persons who undertake to clear and cultivate it, taking as remuneration the crops grown during the interval; no ground share is claimed, and the owner advances seed and maintenance paddy, which are repayable, but without interest. An expenditure of about Rs. 10 in cash is required to put up the dams and bridges, which are frequently of larger dimensions than is usual in the Sinhalese districts. It is difficult to say what the total cost of asweddumizing comes to in money, but, so far as I can judge, it is not more than Rs. 30 per acre, a portion of which is generally recouped by the timber.

The task I set myself is now finished, and I trust it will be considered that I have shown paddy can be locally grown, with the aid of irrigation, more economically than it can be imported. I have endeavoured to give a truthful, fair epitome of the information I have drawn from the lips of all classes, chiefly the practical fieldworkers, with whom I have been brought more directly in contact during the past two years, especially in the Batticaloa District. As regards expenses of cultivation, my inquiries are more than corroborated by the outside and independent testimony of others to which I have already referred.

The only point which is really open to discussion is the rate of yield. This I have purposely kept low, I believe below the truth, and I appeal to the gentlemen who have experience in such matters if I have not been most moderate in basing my calculations upon a yield in irrigated lands which would, in the Sinhalese districts, be spoken of as varying from 10 to 15-fold, and of 7 to 10-fold in the localities where $3\frac{3}{4}$ bushels to the acre are sown.

I have selected for the investigation of this question two districts in which the construction of irrigation works has introduced a considerable element of certainty in the cultivation of paddy, and it is practicable to judge results by pecuniary tests in accordance with European ideas. When a reliable water-supply is absent, and paddy-growing depends on the rainfall, it is probably liable to more vicissitudes than any other branch of agriculture in the Island, perhaps in the world. It would be a waste of time to consider its pecuniary capabilities under such conditions.

But, fortunately, the rainfall in some parts of the Island,

and in the more populous districts, is well distributed, and paddy cultivation is carried on with results only second to those ensured by irrigation. Where such favourable circumstances are wanting, there is really only one remedy, and that may be summed up in the single word "irrigation."

I know no other of equal efficacy. Improved modes of cultivation, new implements, and fresh seed, are all of secondary importance. Where necessary, make the water-supply tolerably secure, and we may and can rival India, if we do not do so already, in the economical production of paddy, though it may be a long day before we can entirely overtake the local demand. Still, the fact remains that while paddy cannot apparently be imported into Ceylon for much under Rs. 1·50 per bushel, we can produce it in the Island for one-third this sum at the very outside.

PLUMBAGO:

With special reference to the Position occupied by the Mineral in the Commerce of Ceylon;

And the Question discussed of the alleged existence in the Island of the Allied Substance, ANTHRACITE.

BY A. M. FERGUSON, ESQ., C.M.G.

(Read 28th August, 1885.)

THE mineral of which this paper treats is a form of carbon, the substance which constitutes so large a portion of organized nature, more especially of the vegetable world. Graphite is in truth vegetable matter mineralized by those various forces of moisture, heat, friction, pressure, and electricity or magnetism, which have so marvellously metamorphosed the primitive rocks in which the mineral is generally, if not exclusively found. In Geikie's Handbook of Geology, graphite is mentioned first in the list of rock-forming minerals, sulphur and iron following, before silica in its protean forms is specified. In a more or less definitely crystallized, foliated, columnar, needle-like, or massive shape, the mineral embodies the altered remains of some of the earliest plant forms which appeared on the earth, when the fiat was uttered in the far back ages of creation, "Let the earth put forth grass, herb yielding seed, and fruit tree bearing fruit." Those of you who entertain a vivid recollection of the fascinating paper by Dr. Trimen on the Flora of Ceylon, recently read in this hall, can imagine the delight it would afford that eminent naturalist and thousands of other scientists, could the brilliant steel-grey to jet-black ore we are considering reveal the secrets of its vegetable origin and show the fibres, the leaves, the flowers, and fruits of the earliest herbage of the morning of the times, from which it has been transformed, in like manner as ordinary coal also generally speaks of the early days of the geologic

ages. But graphite,* (so called from its earliest use in the formation of pencils for writing and sketching,) and which there can be little doubt is closely allied to coal, although generally older in origin, and the subject of more intense and long-continued metamorphic influence than the carbonaceous substance so valuable as fuel, is too highly mineralized (with the exception, perhaps, of the formations in Canada) to display a trace of the vegetable tissues from which it claims its descent.

To the seeker for fossil remains of ancient organic life, therefore, graphite like our other primitive rocks, gneiss and crystalline limestone, is less interesting than are the coal measures, with their wonderfully preserved specimens of plants and animals and shells, on which human eye probably never looked until the operations of the toiling miner revealed their, in some cases, almost perfect lineaments. Graphite seems, in truth, to be the most highly crystallized form of carbon next to the peerless diamond, which poetically, if not with perfect scientific accuracy, has been described as a drop of pure liquid carbon crystallized. If such were the case, the most brilliant rays which light can yield seem to have played on the drop and to have been captured by the agency, perhaps electricity in one of its multitudinous forms, which gave the gem its unrivalled hardness, in addition to unapproachable brilliance and beauty. Graphite (to which, when burnt, the diamond reverts) has a beauty of its own, and as small diamonds have actually been formed by artificial means, the time may possibly arrive when the form of carbon which mineralogists rank only next below the diamond, may, by means of the appliances of progressive science, be advanced from the second to the first place. Let us only attempt to imagine a mass of pure graphite equal to a quarter of a ton, such as that sent to Melbourne in 1880, and the still larger mass which will probably figure in the Court of the

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* Blacklead, Plumbago, Graphite, Wad; (Dutch, *potloot;* French, *mine de plomb noir, plomb de mine, potelot;* German, *pottloth, reissbley;* Italian, *miniera di piombo, piombaginne, corezolo;* Latin, *plumbago;* Spanish, *piedra mineral de plombo.*)—MacCulloch's Dictionary of Commerce.

Colonial and Indian Exhibition of 1886, metamorphosed into diamond "of purest ray serene," and try to conceive the thing of beauty it would be, even if shrinkage in the transformation process reduced its size to one-tenth or even one-hundredth of the original bulk. Meantime it seems curious that Ceylon, so rich in "precious stones," which with all their brilliancy are simply crystallized and coloured clays, should be utterly destitute of specimens of the king of all gems, seeing that diamonds are found close by us in Southern India, and in formations similar to those existing here: laterite, occasionally, and especially in association with corundum, which in Ceylon is so common and of which our most precious sapphires and rubies are but higher forms.

But of more value to Ceylon economically, beyond all comparison, would be the real discovery amidst its rocks of that form of carbon which ranks next to the diamond and graphite, and which seems to be graphite and perhaps diamond in a less altered form. It need scarcely be said that coal is referred to. The late Dr. Gardner, of the Pérádeniya Royal Botanic Gardens who was eminently a geologist, expressed a strong opinion to the effect that where primitive rock—in our case gneiss—forms the surface formation, it is hopeless to look for coal beneath. It is true that in India coal has been discovered in formations or positions where it never would be expected to occur in Europe. But I am not aware that in any case coal has been found underlying, or near the surface of, primitive formations. The only important class of rock, so far as I am aware, which is associated with our Ceylon gneiss, is itself a primitive formation, and is to a certain extent a carboniferous rock—I refer to the crystalline magnesian limestone known as dolomite; this rock contains, in varying, sometimes in large proportion, carbonate of lime, but in that respect alone has it the remotest affinity to coal.

Were coal really, whether the so-called bituminous mineral or the more highly crystallized form called anthracite, to be found in association with this lime and with our abundant plumbago and fine clays, then indeed might the "millions of tons of iron" of which Dr. Gygax wrote nearly forty years ago, and which he said could be laid down at Colombo for little over £6 a ton (with native anthracite at only 18*s.*

per ton) be utilized, so as rapidly to solve the problems of cheapening steam navigation and covering the surface of the island with iron highways. Much of our plumbago, now so largely exported to the Far West, might then be retained and used in the shape of crucibles for the manufacture of Ceylon steel, with more profit than the Sinhalese usually derive from their native iron, on the production of two shillings' worth of which, according to the Swiss geologist abovementioned, the natives spend nine shillings' worth of fuel and labour.

But nothing in my researches with regard to this paper has been to me so great a shock and disappointment as the apparent impossibility of verifying the existence in Ceylon of the valuable mineral—it would be doubly valuable now that planters will largely need just such a fuel as it would yield for preparing their tea—which, between 1847 and 1849, Dr. Gygax professed, with such a flourish of trumpets, to have discovered. He stated that it existed where stone or glance coal might be expected to occur (had "bituminous" coal ever been present), in juxtaposition with basaltic rock, and in such abundance that he estimated it could be delivered in Colombo at the very low price I have named, of 18*s*. per ton!

Specimens of anthracite which Dr. Gygax alleged he had collected in Ceylon were, with other minerals, deposited in the Museum of this Society, and in his report to the government of Lord Torrington, dated 30th June, 1848, Dr. Gygax remarked, speaking of the vast quantity of excellent iron and of its being easily smelted, "But *anthracite being easily found on the spot*, could be used in the proportion of three to one of English coal and much cost saved." Again, in the same report there is a distinct heading for the coal he alleged he had discovered, and he wrote :—"*Anthracite* may be found in precisely similar situations with plumbago. Indeed, whilst the latter is the metallic carbon, the former is a hydrate of carbon. Just as plumbago is found near the basaltic eruptions, so is anthracite found. It is my opinion that this substance exists as abundantly as does plumbago. I recommend exploring the country for it near the Bentoṭa river, half way between Galle and Colombo, and I believe it might be produced for 18*s*. the ton." Writing, too, of the kaolin (*kirimeṭiya* of the Sinhalese), so plentiful in Ceylon, as

suitable for the manufacture of superior bricks and tiles, he referred to the great advantage of the vicinity of anthracite to burn them. He then went on to show the importance of his alleged discovery in view of the mail steamers touching at Galle, a consideration which, shifting the scene, would now, with the vastly increased resort of steam vessels to Colombo, tell with ten-fold force. Tennent, in his beautifully written and widely-read work on Ceylon, endorsed, by adopting, Gygax's statement of millions of tons of iron in one locality in Sabaragamuwa, with a flux in the shape of anthracite ready to hand;* and yet in all these years the inhabitants or colonists of Ceylon have neither bestirred themselves, nor been by outsiders reproached for their criminal apathy in neglecting such magnificent resources, while the island has been several times shaken from its propriety by alleged discoveries of gold in paying form and quantity. In the history of scientific exploration and report, and of colonial history and progress, there seems to be no greater fiasco.

The curious part of the matter is that in his first report of 1847, which is extant in the Colonial Secretary's Office, and the peculiar English of which is uncorrected, the Swiss geologist *said not one word about anthracite,* so prominently introduced into his later report of 1848 from which I have quoted, and the style of which is as purely idiomatic and graphic as that of the great writer on Ceylon who adopted and gave world-wide currency to statements of mineral finds which, if not apocryphal, have certainly not been confirmed by later explorers of our rocks. Any suspicion, however, which might be entertained of Tennent's sincerity in his avowed belief of Dr. Gygax's discovery, is removed by the fact that the latter included anthracite in a collection of the minerals he had personally collected during his official survey, and which, as already stated, he lodged in the Museum of this Society.

True, there was one man, a British merchant, the late Mr.

* Tennent's statement is: "The *anthracite* alluded to by Dr. Gygax is found in the southern range of hills near Nambápána, in close proximity to rich veins of plumbago." The rich veins of plumbago are a reality, but the anthracite seems to be as mythical as Sinbad the Sailor and his gems.

John Armitage, who previously to the advent of Dr. Gygax was stirred to action by the supposed existence of anthracite in Ceylon. But, curiously enough, Mr. Armitage, accompanied by Mr. Wm. Tindall, applied to the Emigration Commissioners in 1846 for concessions to mine for anthracite in Ceylon, not because of any specimens of the mineral he had seen in the island, whether in museums or cabinets, or *in situ*, but because the very finest specimen of anthracite in the British Museum, "presenting a flat surface of nine to twelve inches, and beautifully iridescent like some of the best descriptions of coal," was labelled as from Sabaragamuwa, Ceylon, and because, as Mr. Armitage was assured by the curator, it was genuine, it having come from the collection of a Col. Greville. The name of Greville does not to my knowledge occur, it is certainly not prominent, in the annals of Ceylon.

To show how confusion may arise, I need merely mention that through the dropping of a comma, plumbago is represented in successive works, including the *Encyclopædia Britannica*, as found in "Travancore Ceylon," as if the localities were one. There is the case of *columba* root, too, which received that name because ships touching last at Colombo brought the bitter root to Europe from India. But the crowning absurdity was that the Emigration Commissioners, who had in 1846 the ordering of such matters, instead of saying to Messrs. Armitage and Tindall, "We will refer to the Governor of the colony for information," or "You go and prospect and let us know what you find and under what circumstances, make your offers, and we will consider them," jumped instantly to the conclusion that anthracite of such quality, in such plenty, and in such circumstances of cheap acquirement, existed in Ceylon, that 40 per cent. would be a fair royalty to charge! The gentlemen who were prepared to embark capital in the enterprise were naturally disgusted and deterred, and, what is to be especially deplored, Mr. Armitage seems never subsequently to have practically tested, personally or by his agents, the actual existence of anthracite in Ceylon, although he was resident in the island when the discovery of this species of coal in quantity was authoritatively announced.

Dr. Gygax did not hazard a mere guess, but gave full scientific details of the existence of anthracite not only in

association with plumbago, but in juxtaposition with basaltic rocks, the friction and heat of which when irrupted would, as all acquainted with the principles of geology know, have supplied just the needed agency to convert ordinary gaseous coal into anthracite by the expulsion of the volatile portions. My limited knowledge of the mysteries of geology forbids me to dogmatize, but I have observed, read, and inquired to some extent, and until better advised I must confess to utter scepticism regarding the existence of anthracite in the formations at Nambápána, or anywhere amongst the granitic formations of Sabaragamuwa, or as at all existing in Ceylon.

The strange part of the matter is that Tennent, with his special opportunities of testing the reality of a discovery which he evidently deemed immensely important, never did more than take Dr. Gygax's statements for granted giving them the benefit of amplification and word-painting in his book, a book in regard to most subjects, as correct in statement as it is elegant in style. That Dr. Gygax was not infallible, we have had proof in the case of an assertion he made in a paper contributed to the earlier annals of this Society. He stated that the little land leech, which is such a pest in the damp forests of Ceylon and Southern India, cannot exist on volcanic soil. But travellers in Java and other portions of the Eastern Archipelago have told, from painful experience, a very different tale.

It is not, however, scientific accuracy, but personal veracity which seems at stake in the statement that anthracite not only exists but abounds in Ceylon; and to set this and other like questions at rest, I submit that this Society would do well to use its influence with Government to induce them to borrow an officer, if his services could be spared, from the Geological Survey staff of the Government of India, to examine and report, once for all and with authority, on the geology and mineralogy of our island. Such a man as Dr. Wm. King, with his experience acquired in India, could pronounce on all important points in a period of time probably not extending beyond a year. Dr. King has visited the island more than once, I believe, and is interested in its physical constitution and condition generally, while he is personally connected with Ceylon from the fact that he has a brother in our Civil Service. In regard to a discussion in the *Observer* regarding

the geological age of plumbago, started before the idea of my writing a paper on the subject was entertained, Dr. King wrote to assure me I was right in describing the mineral as one of the oldest formations extant, and in a note which I had the pleasure of receiving from him a short time ago Dr. King wrote :—

"Anent a correspondent in the last *Overland Observer*, don't be led away with too much expectation of valuable minerals (ores) in your gneisses. Exploration is, of course, necessary, but it is often in the less highly metamorphosed rocks—of which you have none in Ceylon—that good mineral ores are found, at least in India. The gold is most disappointing : though you may get traces of gold in almost any region of our crystalline rocks (gneiss, &c.), you see what a failure Wainad has been ; and so was Mysore until lately. However, I yet believe that moderate returns will be got from some of the reefs in Wainad ; but not to pay for the awful charges on purchase of land and expenditure on machinery, or prices of promotion money, or extravagant preparation in highly paid officers, plant, bungalows, &c."

Dr. King's opinion as to the improbability of the existence in any quantity of valuable mineral ores in our metamorphic rocks, is in entire consistency with the previous utterances of Dr. MacVicar, Dr. Gardner, and other qualified authorities. It is significant that both Dr. MacVicar and Dr. Gardner should have passed by unnoticed the alleged discovery of anthracite by Dr. Gygax, and still more so that Mr. Alexander Dixon, in his list of Ceylon minerals sent to the Melbourne Exhibition, took no notice of anthracite, although he sent a specimen of plumbago associated with crystalline quartz, as also iron pyrites from Nambápána, the very locality in which Gygax professed—so Tennent understood him, as general readers of his report must have also understood him—to have found graphite, anthracite, and basalt in association. Neither—and this is very significant —did Mr. Dixon say a single word about any form of coal in the list of Ceylon minerals (eighty-six varieties) prepared by him for insertion in the Transactions of this Society in 1880, and which he naturally rendered as complete and exhaustive as possible, including, as it did, specimens of plumbago from Kurunẹgala, Kẹgalla, and Nambápána.

It may be added that no trace of anthracite has been detected in India, although ordinary coal exists in many places, and graphite, distributed in crystalline rocks, is abundant from

south to north of the continent. Near Darjiling, in the district of British Sikhim, there is a very curious result of the crushing of coal by slipping mountain strata. The friction of the process must have evolved heat to a considerable degree, but instead of anthracite the crushed coal was converted into a substance which the geologists have named "semigraphite," —a hint here, probably, of the agencies at work in producing true graphite in India, Ceylon, and elsewhere. Indeed real graphite *has* been found as the result of the alteration of a coal seam by intrusive basalt, as at New Cumnock in Ayrshire. So writes Geikie, but like other geologists he notices graphite as being amongst the older formations, where it occurs in distinct lenticular beds and also diffused in minute scales. Geikie's full description of the mineral is given in a note.* In

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* *Graphite.*—Rarely crystallized in hexagonal forms, usually granular scaly, or compact. H. 0·5—1·0. Gr. 1·9—2·3. Nearly pure carbon, but generally with at least 1 or 2 per cent. of silica, lime, iron, or other impurity. Under the microscope, opaque; appearing velvet black with reflected light. Found chiefly in ancient crystalline rocks, as gneiss, mica-schist, granite, &c.; some of the Laurentian limestones of Canada being so full of the diffused mineral as to be profitably worked for it; in rare instances coal has been observed changed into it by intrusive basalt (Ayrshire). Probably in most cases the result of the alteration of imbedded organic matter, especially remains of plants; occasionally observed as a pseudomorph after calcite and pyrites, and sometimes enclosing sphene and other minerals.

Graphite is little affected by percolating water, hence it is not a replacement mineral. But Vom Rath has described an example from Westphalia, where calcite has been partially replaced externally by an encrusting pseudomorph or graphite.

Geikie also states: "The opinion of the organic nature of *Eozoon* has been supposed to receive support from the large quantity of graphite found throughout the Archaean rocks of Canada and the northern parts of the United States. This mineral occurs partly in veins, but chiefly disseminated in scales and laminæ in the limestones and as independent layers. Dr. Dawson estimates the aggregate amount of it in one band of limestones in the Ottawa district as not less than from 20 to 30 feet, and he thinks it is hardly an exaggeration to say that there is as much carbon in the Laurentian as in equivalent areas of the carboniferous system. He compares some of the pure bands of graphite to beds of coal, and maintains that no other source for their origin can be imagined than the decomposition of carbon dioxide by living plants. In the largest of three beds of graphite at St. John he has found what he considers may be fibrous structure indicative of the existence of land-plants."

North America the conversion of gaseous coal into anthracite has been distinctly traced to the powerful chemical forces evolved by the tilting up of previously horizontal strata.

Mr. Alexander Dixon described, or intended to describe, for the annals of this Society, a deep-seated deposit of what no doubt was drift timber carried down by floods in the Kẹlani river, and which was discovered in the course of the borings made in connection with the erection of the new railway bridge near Colombo. Deposits of this kind may in the process of far future ages give Ceylon coal, or at least lignite, but at present I fear our formations include nothing more nearly approaching coal than the apparently poor species of peat found at Muturájawela near Colombo, in Nuwara Eliya, and some other swampy places, apparently the result, chiefly, of decomposed aquatic and semi-aquatic plants, such as flags, rushes, and grasses. On the Nilgiris, I believe a somewhat similar but evidently superior formation is used as fuel, after being compressed and dried, but I am not aware that any experiment in this direction has been tried in Nuwara Eliya. The owners of the brewery and of the adjacent tea plantations might probably find it worth while to test the combustible value of the black peaty matter, compressed into bricks and thoroughly deprived of moisture. For use in tea houses, however, there might probably be the objection of the peaty smell, while anthracite, if it really existed, would be, like coke, free from objection on the score of odour, and for tea house purposes its intense smokeless heat would render it specially valuable.

The table of descent amongst mineralogists seems to be from the diamond to graphite, next to amber, and then coal, peat, and petroleum. In connection with coal formations and petroleum springs, shales are always found, but certainly no writer on Ceylon has ever said that any formation, even remotely resembling oil-bearing shale, has been seen in our rocks, any more than that a Ceylon well-digger has ever "struck ile." Seeing that Indian rock strata include the diamond, while the gem-bearing rocks of Ceylon, rich also in graphite, show no trace of the brilliantly crystallized carbon which shines in crown and diadem as the diamond, the case might, some would say, be reversed as regards anthracite, which although absent from the Indian continent might exist

in the Indian island; but all the evidence as yet seems to show that as regards the existence of anthracite in Ceylon, a huge and very annoying mistake has been made, and that all the probabilities, unfortunately, are adverse to the discovery of any form of coal in our rocks.

I feel sure I need not apologize for the space devoted to a matter so closely connected with the subject of the paper I have been asked to prepare, and of such incalculable importance to Ceylon, should Dr. Gygax, after all, be shown by the indisputable "testimony of the rocks" to have been in the right. No one would more sincerely rejoice than the writer of this paper, were such to be the answer to the question he has felt it his duty to raise. There seems to be no trace left, in the Museum, at any rate, of Dr. Gygax's specimens of so-called anthracite. Anxious not to do injustice in the matter, however satisfied my own judgment was of the completeness of the negative evidence, I referred the question before giving an adverse verdict to a most competent authority, and his deliverance is :—

"I think you may safely assert that there never was any anthracite in Ceylon. The only thing resembling it that Gygax was said to have seen was a piece that was brought from about Haldummulla. But it would not have been the only piece in the Island had it been anthracite ; and, handling plumbago as I have done for the last 20 years, I would scarcely have failed to see some of it, if it existed."

This seems conclusive; and if Gygax received a specimen of anthracite from Haldummulla, it was probably a piece sent from England as a guide to research. There was, nearly forty years ago, some excitement created by an alleged discovery of true coal in Héwáheṭa, the discovery having no better basis than some bits of English coal washed down an estate stream from the late General Braybrooke's bungalow.

The calculation is that the amount of mineral fuel consumed in India in 1882 was equal to 1,500,000 tons, of which only one-third was imported. At the pit's mouth in Raniganj, local coal can be delivered for 2½ rupees per ton, while the average price of imported coal, although taken from Britain almost as ballast, at exceptionally low rates of freight, has been over Rs. 18. In consequence of the

presence of abundance of coal near the line, the East Indian railway obtains its fuel at a rate cheaper than any other railway in the world. If coal of passable quality and in large quantity were produced in Ceylon, we might even supply the demands of some parts of India which are far from territorial sources of supply, besides meeting an ever-increasing local demand for steamer, factory, railway, gas-works, and general purposes, which was represented by an import rising from 81,000 tons, in 1880, the year in which the Colombo harbour first gave shelter to steam shipping, until now the annual introduction of foreign fuel into the island is close on 200,000 tons, of a local value of over £400,000. The figures for 1883 were 195,883 tons, and for 1884 nearly an equal quantity. The total for the five years ending 1884 was 742,000 tons, and the average 148,000 tons; but the resort of steamers to Colombo is increasing at such a rate that it may be safe to predict an aggregate of 1½ million for the five years ending 1890, making an annual average import of 250,000 tons; that is, unless some great discovery in the economy of fuel in steam navigation is made in the interval. If, therefore, the supposed presence of coal in Ceylon was considered so important in 1848, how much more so would its real discovery now be deemed!

But if the diamond, amber, coal, and petroleum are absent from our rock formations, happily there can be no question as to either the quality or the quantity of our mineral carbon in the shape of PLUMBAGO, of which indeed, in the form most valuable for the manufacture of metal-melting crucibles, Ceylon seems to have as much a natural monopoly as she has of first class cinnamon in the vegetable world. There are, no doubt, vast deposits of graphite in North America, especially in Canada, but the mineral seems to be generally diffused in rock from which it is difficult and expensive (labour being scarce and dear) to separate the small particles. Graphite, although rare in a form economically valuable, seems very widely distributed over the face of the earth. In India plumbago has been found in a large number of places, and has been the subject of many experiments and much discussion, but the results have been hitherto disappointing. It generally appears sparingly in very quartzy rock, and in heavy ferruginous gneiss. The mineral is

deficient in lustre, contains much iron, and one specimen gave 35 per cent. of lime. Lime is, perhaps, even more fatal to the value of plumbago than iron, and although graphite may occur in the magnesian limestones of Ceylon (I never heard of but one instance,) it is quite manifest that digging in the dolomite need never be resorted to, the mineral being so plentiful in our quartzy gneiss, where the only enemy encountered, and that, happily, not very frequently, is iron. Like some other adversaries, this one sometimes appears in guises the most radiantly beautiful, in the present case as pyrites varying from splendidly crystallized masses, with facets polished like finest silver, and again simulating auriferous treasures by putting on the most glorious colourings of gold, shading away to a lovely and delicate green, indicative this tint, it is supposed, of the presence of sulphate of copper.

This auriferous coloured pyrites is appropriately named in Sinhalese *Diya rat-ran*, or 'water gem-gold,' the recognition of water as the agent to which the formation and its brilliant colours are largely due being, curiously enough, in perfect accord with the conclusions of the most advanced geological scientists.

To Mr. Williams, Acting Government Agent of the North-Western Province, I am indebted for a collection of interesting specimens from Polgola on the road to Dambulla, showing how plumbago is associated with and forms round a nucleus of crystalline or semi-opaque and sometimes garnetiferous quartz (the position of the minerals being, I am told, occasionally reversed), and quite a number of pieces of rock which the non-scientific might well be excused for regarding as coated and permeated with brilliant golden ore. These may be regarded as the flowers of the subterrannean regions where plumbago is mined. I am bound to state, however, that the brilliancy of iron pyrites has no effect in modifying the inimical feelings with which those connected with the plumbago enterprise regard the mineral, while they talk with disapproval and disgust of the *Yabora* = (*a*) *ya* iron, *bora* dross, iron dross, the hard, iron-like form of plumbago; and any one desirous of procuring specimens, will be made heartily welcome to what in the eyes of the plumbago dealer is associated with a rocky, inferior, and unsaleable product. But truly the pure

soft mineral itself, in its various forms of crystallization, the most prevalent being a radiating star-like arrangement, and its variation of sparkling colours from steel grey to plates of jet black, may be regarded as a veritable "thing of beauty." A collection of first class lumps, each highly polished and lustrous, intended for shipment to Germany, which could be seen at Mr. W. A. Fernando's store recently, was certainly a striking sight. In connection with this collection of silvery masses, Mr. Fernando showed us specimens of a dark-coloured variety, of needle-like formation, which he said he had been requested by his customers to make up separately, as the ordinary mills could not easily grind that particular quality. Graphite generally, like iodine, shows a bright metallic sheen, but it is at once distinguished from the true metals by its soft and unctuous mechanical condition. I am speaking of first class mineral, for, showing us a specimen of plumbago formed, apparently, over an ironstone nucleus, Mr. Fernando declared such ore to be unsaleable. In truth, the reasons why our Ceylon graphite is so much sought after, are the entire absence of lime from the mineral, and in most cases its equal freedom from ferruginous particles, the small proportion of foreign substances, if any, being volatile matter and minute fragments of silica and alumina. Besides grinding to extreme fineness, an acid bath is used thoroughly to purify graphite used for certain delicate purposes, such as electrotyping, when the finest and purest dust is required to coat surfaces of wood, plaster of Paris, and gutta percha, &c., to render them conductive. An authority of all in the world, perhaps best qualified to speak, describes Ceylon plumbago as combining the two qualities of being almost as refractory as asbestos and at the same time the most perfect conductor of heat.

The North of England mines, which at one time supplied the world with pencils, although ordinary lead pencils have been in use in the present century, seem exhausted, while the supply of the somewhat allied mineral—jet—is still available for the manufacture of ornaments at Whitby. There is graphite in Scotland, (plentiful in Aberdeenshire according to Mr. Ferguson of Kinmundy) though not, I believe, of useful quality. The black lead mines spread

over Germany—in Prussia, Austria, Bavaria, and Bohemia—are only second in fame to the peerless English pits; while finds of the mineral are reported from places so widely separated as North America, Finland, Greenland, Siberia, Spain, Australia, Japan, and Madagascar. It is a curiously suggestive fact, too, that traces of this form of carbon have been found in meteorites which have reached our globe from the regions of planetary space.

In addition to a large lump of Pasdun Kóralé plumbago on the lower floor of the Colombo Museum, the gift of Sir Charles Peter Layard, beside which stand specimens of plumbago crucibles from the Battersea Factory, there are, in one of the mineral cases upstairs, associated with pieces of the Ceylon ore, pure or with a rocky matrix, a collection of graphites presented by Mr. W. W. Mitchell, illustrative of the mineral as found in Siberia, Canada, Finland, Japan and Travancore. Allowing for the fact that the foreign plumbagos are dulled by time and climate, their appearance certainly does not convey any idea of superiority over our local product.

If Bennett (author of "Ceylon and its Capabilities") is correct, Ptolemy mentioned this substance amongst the productions of Ceylon, when writing in the second century of our era. It is curious that Bennett, of all the writers on the Island, should alone have made this statement. Tennent, who carefully epitomized the geographical information contained in Ptolemy's writings, does not quote him as mentioning the mineral. Pridham, of whose classical research Tennent entertained a high opinion, is equally silent. Mr. Green, Director of Public Instruction, kindly endeavoured at my request to test Bennett's statement by reference to Ptolemy, but no copy of the original work was accessible, and a summary of Ptolemy's statements in the *Indian Antiquary* does not confirm what Bennett wrote. Should further research show that Ptolemy really mentioned plumbago, it would be interesting to ascertain if the native name (Siṉhalese or Tamil) was merely transferred, or if a word was used indicative of a knowledge by the Greeks and Romans of graphite and any of its uses.

If the ancient native historical records, in their almost exclusive devotion to the glorification of monarchs who

built irrigation works and promoted the interests of Buddhism, failed to notice cinnamon, it is no wonder they make no mention of *kalu-miniran,* which though lustrous as silver was neither a precious metal nor a precious stone fitted for the adornment of kingly crown or royal palace,—palace far inferior to thousands of European kitchens, with their iron stoves and grates shining with the brilliancy of highly polished "black lead." To Mr. W. P. Ranesinghe I am indebted for the information, conveyed in a letter which is printed as an appendix to this paper, that *kalu-miniran* (*black* miniran, the word *miniran* applied to mica signifying *mini* = *mani,* gem, and *ran* = *ratna,* also gem, or the 'golden gem,' just as two superlatives, *gloriosa superba,* are applied to the splendid inverted lily of our jungles) is mentioned in a native work, the date of which it is difficult to fix, but which seems to have been written in the fourteenth century of our era. In this medical work "*Yóga Ratnakaré*" ('the ocean of the gem-like prescriptions') directions are given for reducing *miniran,* that is mica, to ashes that it may be taken as a medicine, while to fit *kalu-miniran* (graphite) for similar use it has to be purified by means of the milky juice of a *euphorbia,* and boiling for three days over a low fire such as is used for boiling rice. The small pieces subjected to the processes mentioned are finally taken out and washed, and they are then purified and fit for use. The affections for which this purified carbon is prescribed are not mentioned, beyond the statement that it is used as a tonic, but we all know how largely the antiseptic properties of charcoal are valued and applied, a digestive charcoal biscuit being at this moment prominently advertised and pretty extensively used. I have also in my reading come across a notice of the use of coal as a medicine, the purer forms being probably chosen, while a paragraph has recently appeared stating that "a chemist in Munich has succeeded in obtaining from distilled coal a white crystalline powder which, as far as regards its action on the human system, cannot be distinguished from quinine, except that it assimilates even more readily with the stomach. Its efficacy in reducing fever heat is represented as quite remarkable, and it even renders the use of ice unnecessary."

But in the process of my researches I find that it is not only the ancient Sinhalese wedarálas who prescribed graphite. The English black lead, it seems, was formerly held in high repute as a medicine, and a writer on the Cumberland plumbago in 1709 asserted it was much sought after by physicians and apothecaries as being a present remedy for colic, gravel, and other diseases. The use of *euphorbia* juice in the purifying process applied in Ceylon to plumbago is very curious and interesting, the powerfully active properties of *euphorbia* "milk" being well-known. The Tamil coolies are said to give doses of *euphorbia* juice to new-born infants for the alleged purpose of clearing away impurities, but the result is probably to account in a large measure for the high rate of infant mortality amongst the class referred to. Any one who knows, as the writer does, the agony arising from a single drop of euphorbia "milk" getting into the eye, will appreciate the effect of this caustic poison on the delicate internal organs of infants. On the external skin it acts as a blister. Its action on graphite is probably to dissolve away the impurities mixed with the mineral in the shape of particles of gneiss, quartz, iron, &c. Having seen it stated that in connection with specimens of plumbago at the Exhibition of 1862, the eminent surgeon, Sir Benjamin Brodie, had fully discussed the properties of the mineral, I requested Dr. Vanderstraaten to ascertain if Brodie's views were embodied in any book in the Medical Library; he has replied in the negative, but tells me that the Chinese use both black lead and white as medicines.

The species of carbon of which we are treating never forms a compound with any other substances, and large masses of it are often found so pure that the return of carbon to the analyst is sometimes considerably above 99—very nearly 100 per cent. indeed, while the specific gravity of the soft and unctuous mineral compares with that of the diamond thus: diamond 3·6; graphite 2·2. The fact may not be wanting in significance, that quartz occasionally encloses drops of liquid carbon, destined perhaps to emerge, after a very long period of intense heat and pressure, as solid gems. (?)

In cases of impaired digestion, purified carbon, in the shape of graphite, may well be conceived to have valuable corrective effects, but native treatment is generally so empirical that

we may err in giving the ancient wedarálas credit for knowledge of the principles on which certain substances ought to be exhibited. If there is really no mention of plumbago in Siṇhalese records earlier than the fourteenth century A.D., it is a curious fact that a document should exist in Europe, supposed to be ruled by means of the mineral, of date 1387—that is in the very same century. But, although some form of pencil must have been known and used from time immemorial, notably the lead pencil with its paler mark than that of plumbago, the first mention of a rough "black lead" pencil, was by Gesner in 1565, about the time when the famous Cumberland mines were discovered.

I have not been able to ascertain if plumbago, the Tamil name of which is *kár-iyam*, is mentioned in any ancient Tamil records, and I cannot trace any notice of the mineral by Muhammadan or Chinese voyagers, while Portuguese writers on Ceylon seem, so far as they have been consulted, to give no sign of a knowledge of black lead or its properties. The effect of the publication of this paper may be, however, to reveal matter not within my reach, although I did not fail to refer, directly and through competent scholars, to a very large number of the best authorities. The officer of the late Ceylon Rifle Regiment who wrote a book on Ceylon stated that Thunberg, the Scandinavian naturalist, who wrote in 1777, was the first to notice plumbago as a product of Ceylon. This was an error. Robert Knox, who wrote in 1681, mentions the existence of the mineral; and Valentyn gives a letter of a somewhat earlier period by the Dutch Governor Rykloff van Goens, dated 24th September, 1675, addressed to his successor the Governor-General Jan Maatsuyker, in which he mentions veins of plumbago *(potloot)* in the hills, and mines in the low-country. He described it as a product of quicksilver, an error which, repeated, may explain the alleged discovery of a mine of quicksilver near Kóṭṭé, soon after the British took possession of Colombo. So important was the latter discovery deemed at the time that a military guard was placed over the mine; but subsequently the existence of quicksilver in Ceylon became as mythical as that of anthracite seems now to be, or the alleged discovery of coal by the Dutch who are said to have disregarded it in view of

the abundance of wood fuel. The old Dutch Governor's notice of plumbago is so curious that it may be well to reproduce its terms. The translation from Valentyn is as follows :—

"Of the other minerals found in the hill-country there is little to be said, for want of information ; but we ourselves have found both black lead [*potloot*] and common lead ; from which metallurgists, infer that there must also be quicksilver there, of which black lead is the product. It is also believed that in the low-country, where the black lead is found, large mines will be discovered so that it seems necessary to inquire into this further, with a view to quicksilver, as this is as it were the blood of minerals and a sign of richer mineral."—Vol. V., p. 205.

Changes the most extraordinary are now known to be produced by metamorphic agencies, but I suspect that even the most potent forces at work in nature would be powerless to change mercury into black lead. Modern mineralogical science, too, scarcely recognizes the principle that quicksilver is the blood of minerals, and its occurrence an indication of the existence of still more precious minerals. The possible solution of the anthracite mystery may be that although graphite is no more a carburet of iron, as it was once deemed, than it is a darker form of the common metal lead, yet iron in very anomalous forms is sometimes associated with plumbago. I was once in possession of a bit of iron formation found in a plumbago mine, which so closely resembled the rootlet of a plant, that the probability seems to be that particles of iron ore in the soil had aggregated round a tree root, assuming its shape and taking its place, after a fashion which gold and other metals have frequently adopted. When rock thus takes the place of wood, we call the result a petrifaction. In the case of metallic particles, the process may be regarded as a form of natural electro-plating, a process in the arts for the success of which the use of good conducting graphite (for some is said to be non-conducting) is essential. There is, it may be well to say, a metallic graphite produced in iron furnaces, known to the workmen as "kish," but it differs somewhat from natural plumbago, which is all and always immediately of vegetable origin, whether the vegetation has passed directly into graphite or through the intermediate stages of coal or shale.

But to return to the place in history of our subject. A

Mr. Ive, who wrote apparently in 1755, professed to have discovered "black lead" and copper ores in Ceylon. Mr. W. P. Ranesinghe has unearthed for me the tradition that the last King of Kandy, infamous for his cruelties as he is famous for his esthetic taste, added to his many-sided character a development of the commercial instinct, supplying, it is said, plumbago to merchant ships, more than seventy years before such enterprising traders as the Fernandos and De Mels appeared on the scene. The tradition seems also to indicate that some of the plumbago in which the monarch traded was dug from a mine on the lands of Molligoḍa Disáwa. Cordiner who wrote at the commencement of this century, stated :—"Plumbago is found with mica at the foot of mountains, in clay and red earth, most frequently at a considerable depth : but is sometimes met with by itself in dry soil."

In more modern times, 1812-20, Dr. Davy, the brother of Sir Humphrey, mentioned plumbago as a mineral found in Ceylon, "which might become an article of export." Dr. Davy was apparently correct in his scepticism as to the existence in Ceylon of ores of quicksilver, copper or tin, but wrong in doubting the existence of gold. Coal however is not, like gold in its very wide diffusion. Still, the mistake of Davy in regard to gold forbids dogmatism. Bertolacci, who wrote his work on the commerce of Ceylon in 1816, although he dealt with every article of any importance in detail up to the end of 1813, makes not the slightest mention of plumbago. The export of the article must have commenced between 1820 and 1830, however, for Mr. Joseph Dixon, the founder of the great American Crucible Company, obtained a shipment of Ceylon plumbago in 1829. In that very year Col. Colebrooke, one of the Commissioners on Ceylon affairs, stated in his report that provision had been made for the delivery of cinnamon and black lead in the Kandyan Provinces (then including the Seven Kóralés) at fixed rates. Reference to the Government Calendars shows that there is no mention of plumbago until 1831, when it was included in the list of articles liable to export duty, the rate being 10*d.* per cwt. The amount of revenue at this rate in 1832 was £22 18*s.* 6*d.* The mineral did not, however, assume real importance in the commerce of Ceylon until 1834, and for the half century which has elapsed between

that year and the end of 1884 I possess, thanks to the courtesy of the Assistant Auditor-General, Mr. C. Dickman, full details of the rise, progress, and fluctuations of the trade, until from small beginnings it has in the past five years attained truly important dimensions, whether regard be had to the quantity and value of the mineral exported, or the revenue derived by Government from a royalty finally fixed in 1877 at the very moderate rate of Rs. 5 per ton.

For the first three years of the period beginning with 1834 no export duty was levied on this article. From 1837 to 1846, and again from 1858 to 1869, a duty of 2½ per cent. was levied, which yielded in the earlier period sums so low as Rs. 12·25 in 1839, rising to Rs. 759 in 1846. In the second series of years, when export duties were levied expressly for railway purposes, the duty rose from Rs. 1,190 in 1858, to the appreciable sum of Rs. 22,240 in 1869. The latter sum was levied on cwt. 226,132 valued at Rs. 889,620. The rated duty seems, therefore, to have been as nearly as possible one-tenth of a rupee per cwt. The only Customs impost to which plumbago is now liable is, apart from the royalty, 7 cents per barrel, recently exacted for harbour purposes. As each barrel contains 5¼ cwt. net of mineral, the burden is only a fraction over one cent per cwt., in addition to the royalty which since 1877 has been levied at the rate of Rs. 5 per ton, or 25 cents per cwt., equivalent to 2½ per cent. on the Customs valuation of Rs. 10 per cwt., but rising to 5 per cent. if the real value is only about Rs. 100 per ton. Previously to 1851 no royalty was levied, and the varying rates since then have been—

In 1851 per ton	...	4*s*.	In 1864 per ton	...	16*s*.
„ 1852 „	...	5*s*.	„ 1869 „	...	30*s*.
„ 1859 „	...	7*s*. 6*d*.	„ 1873 „	...	Rs. 10
„ 1862 „	...	14*s*.	„ 1877 „	...	„ 5

There can be no possible question, it would seem, of the propriety of exacting a royalty, moderate in proportion to its market value, on this mineral, which is entirely an article of export, and which is as much the property of Government, or the people of Ceylon, as are the pearly treasures of the "oyster" banks off Aripu,—providing, too, as the revenue from plumbago does for the construction, amongst other

public works, of means of communication which facilitate and cheapen the operations of the diggers. We could only wish that copper, tin, nickel, and other ores which have been so positively written about as occurring in Ceylon, with gold, which beyond question does exist, were found in quantities sufficient to add appreciably to the revenue in the shape of royalties. The one necessary qualification is, of course, that the amount of the tax should be such as not to bear heavily on an enterprise which is always toilsome and often precarious. Taking the average value of plumbago at Rs. 10 per cwt., the Customs figure, the present impost of 25 cents is, as noticed above, only equivalent to a rate of 2½ per cent., which certainly cannot be complained of as unduly onerous, however justifiable complaints and remonstrances were when 14*s*., 16*s*., and even 30*s*. per ton were exacted, or Rs. 10 between 1874 and 1877. The present rate has the merit of being light, easily collected, and productive, for in the five years ended 1884 an average export of nearly 12,000 tons per annum, of an annual value of Rs. 2,400,000, yielded royalty equal to a yearly average in round numbers of Rs. 60,000. When the proceeds of digging licenses and leases of Crown lands, and stamps on those leases are added, the average may be raised to Rs. 65,000. The maxima of quantities exported, total value, and total revenue were reached in 1883 when the figures were :—

Plumbago exported	...	... cwt.	262,774
Value @ Rs. 10 per cwt.	...	... Rs.	2,627,737
Total revenue	Royalty ... Rs. 65,694 Leases & licenses 4,727	... ,,	70,421

Wonderful contrasts these, even if we reduce the Customs valuation by one-half, to an export of only 423 cwt. in 1839, valued at only Rs. 490, or a little over Rs. 1 per cwt., and yielding to the revenue of the Colony only Rs. 12·25, a sum scarcely worthy of collection! The totals for the whole period of half a century of the export trade in Ceylon plumbago are striking, viz. :—

Quantity exported	...	cwt.	3,526,000
Value of this quantity	...	Rs.	25,742,000
Contributions to revenue	...	,,	841,000

Crediting plumbago revenue with items brought to account under stamps and other headings, the amount

might be raised to Rs. 900,000, and had Government always got its own in the shape of royalty, the round million of rupees would be considerably exceeded.

Taking averages of qualities and periods, it is probable that Rs. 200 per ton is too high a valuation for this mineral, and that twenty millions of rupees would more nearly than twenty-five millions represent the total value of the plumbago exported in fifty-one years, for which figures are given. At any average price of less than Rs. 100 per ton it would probably not pay to dig plumbago, and as a matter of fact what was evidently over-production between 1880 and 1883, led to a reaction in 1884, when not only did exports fall off, but operations in the preparing yards in Colombo were stayed for a time by general consent, some not opening again even when the probability of a war with Russia gave a fresh fillip to the trade.

It is a melancholy fact that plumbago is one of the class of articles like "villainous saltpetre" and some others, the trade in which prospers when war has broken out or when warfare is threatened. The reason in the case of our staple mineral is, that the chief use by far to which Ceylon plumbago is put is the manufacture of crucibles, nozzles, &c., employed in the preparation of Bessemer and other steel, now in such large requisition for shipbuilding, plates for ironclads, torpedoes, shot, shell, &c.; this, in addition to the melting of the precious metals for which crucibles of refractory plumbago are eminently suited from their superior strength and perfect smoothness. There are many minor uses to which plumbago is put, as will hereafter be shown, but I believe I am right in stating that its extended consumption (if that word can be correctly applied to an article which is almost unconsumable) in recent years, is due to the great and rapid advance of the steel industry on both sides of the Atlantic, not merely to provide materials for ships, durable and light, but for the dread weapons and appliances of modern warfare, such as Krupp and Armstrong guns, steel shot, &c. But the abundance of the ore in Ceylon, and the enterprise and activity with which the mining, preparing, and shipping of the mineral have been pursued, have in this case, as in so many others, recently led to production considerably in excess of demand, so that

the profits of the pursuit, never very great and always precarious, have recently been low or *nil.*

When at its highest market value I do not suppose that Ceylon plumbago ever sold for more than £50 per ton: indeed the highest price of which I have evidence is £48 realized by Mr. W. A. Fernando, of Brownrigg-street, Colombo. What is this to the celebrated Borrowdale pencil "black lead" mines, which, after having been worked since the reign of Queen Elizabeth, recently gave out, so that now pencils picked up at Keswick as curiosities cost sixpence each, being formed, if local ore is really used, of fragments found scattered amongst rocks or in the beds of streams! In the report of the Mátara District for 1870 the Assistant Government Agent stated :—

"To meet Ceylon plumbago in Cumberland was certainly a surprise ; but when recently at the English Lakes I learned that plumbago from this Island was mixed with the local graphite to make good pencils."

In the palmy days of the plumbago mines of the North of England the black lead obtained from them was valued at 30*s.* per pound, or over £3,000 per ton, or within about two-thirds of the price of ordinary gold. We cannot be surprised therefore to learn that a couple of centuries before the world heard of the gold escorts of California and Australia, the black lead of the English Lake region was guarded in its transit, in carts, from mine to manufactory by parties of military, the robbery of black lead mines being, by an Act of George II., constituted a felony. The Act, curiously enough, recited that black lead was employed for divers useful purposes, and more especially for the casting of bomb-shells, round shot, and cannon balls. The connection, therefore, with the art of war of the mineral so long associated with the most intellectual and humanizing of the arts of peace—writing and drawing, to wit—does not date from yesterday, neither was appreciation of the value of the Borrowdale mineral of late date, for a grant of the manor of Borrowdale as far back as the reign of James I. refers to "the WAD holes and WAD, commonly called *cawke*." The affinity of graphite to coke, whether artificially obtained from coal or naturally occurring as anthracite, was thus early recognized.

The quality of the Borrowdale ore, dark-coloured, pure and soft, rendered it eminently suitable for pencils of the finest descriptions, and for about two and a-half centuries the world was practically supplied with pencils from this one source. From one pound of the ore, worth 30*s*., or at the rate of £168 per cwt., the number of pencils cut averaged from 18 to 20 dozens. The mineral was stated to be found in pipes, strings, and irregular masses called "sops," a description which, substituting modern terms for olden, applies equally to the Ceylon graphite formations. Since the exhaustion of the Cumberland mines, the best ore for pencils is *said* in some books to be obtained from Siberia, while no doubt the massive and soft stove polish black lead, occurring in various parts of Germany—Bavaria, Bohemia, &c.—is applied to the manufacture of pencils. It cannot be questioned also that some of the finest quality Ceylon plumbago is thus used in Britain, and also in the United States, notwithstanding directly contradictory statements on the subject, one writer declaring that the presence of grit or iron rendered the much-lauded Siberian mineral unsuitable for pencil manufacture; while another, with equal positiveness, writes that, notwithstanding the acknowledged purity of Ceylon plumbago, it is not applicable to pencil-making.

The old method of making pencils was to saw blocks of so-called black lead into strips to be inserted in cedar wood cases, but now the general mode of manufacture—and this applies to crucibles as well as pencils—is to grind and comminute the ore as finely as possible, and then after washing and intermixing with definite proportions of certain qualities of clay, also ground fine, to subject the mixture to tremendous pressure and to a baking process. For blocks composed solely of black lead dust, prepared for pencil-making, the air-pump has also been utilized to render the blocks perfectly solid. Germany, besides supplying the form of so-called "black lead" suitable for stove polish and pencils, yields also a peculiar kind of clay, which in the United States at any rate is used to give adhesiveness to the ground particles of plumbago when subjected to the extreme pressure which has been mentioned. Secrecy is, I believe, observed at the Battersea Crucible

Works as to the exact substances and processes used to give adhesion, but there can be little doubt that there, as in all other manufactories of plumbago into crucibles, nozzles, pencils, &c., fine clay of some sort is used in varying quantities. Into coloured pencils, clays no doubt enter still more largely.

The earliest pencils used were, probably, pieces of chalk and clay, true lead pencils succeeding, until perfection for drawing, writing, and ruling purposes was attained by the use of "black lead," properly graphite—a name which indicates, as already noticed, the large use of the material by artists and in literature. Into pencils, the marks of which cannot be erased, aniline dyes are said to be introduced, but the test of a good black lead pencil is now what it always has been, the ease with which a black mark by its means can be made on paper and again erased. Molybdenite, on the other hand, which abounds in Ceylon and closely resembles plumbago in appearance, leaves a green streak. For inferior pencils Mexican and Spanish lead dust mixed with antimony has been used, but the marks made by such pencils cannot, like those of black lead, be easily removed by India-rubber.

Of course the importance of black lead pencils for ruling purposes has been greatly lessened by the invention and application of machines which rule with pens and coloured inks, but for drawing, taking memoranda, &c., pencils are still used to an enormous extent, of which some idea may be formed from the fact that one manufactory in the United States turned out sixteen millions in the one year 1882. This, however, is as nothing to the estimated annual outturn of Nuremberg, where twenty-six factories employing 5,500 persons, produce two hundred and fifty millions, valued at £400,000. Counting those made in America and Europe together, the total for the world cannot, probably, be less than one thousand millions of pencils per annum, worth at least 1½ million sterling.

It is curious that the quaint old city of Nuremberg, besides being the principal toy depôt of the world, should also be the principal source of supply of pencils. It seems that when the English mines showed signs of giving out, the firm of the old Faber family in the

German city began the manufacture of pencils with pulverized graphite cemented into solid blocks by means of gums and similar substances; but useful pencils in quantity were manufactured only after Conté of Paris in 1795 devised the process by which now all black lead pencils, and indeed pencils of all sorts, are manufactured. As will be seen subsequently, this is the process adopted in The Joseph Dixon Works in America, and the writer in the *Encyclopædia Britannica*, from whose article I am quoting, asserts that the Conté method has, now that even dust cannot be obtained from Borrowdale, quite superseded the processes patented by Mr. Brockendon in 1843, of subjecting pure graphite to enormous pressure and air exhaustion.

In the Conté process graphite and clay are first and separately brought to a condition of the finest subdivision, the graphite being calcined to a bright red heat. The particles of each mineral are then floated from one vat of water to another, the finest particles last to sink being of course used to make the finest pencils. The minerals are then thoroughly incorporated, ground together (that is the various qualities), placed in bags, and squeezed in a hydraulic press to the consistency of dough. The mass is then forced through apertures, taking the shape of pencil rods, and being finally subjected to more or less furnace heat as hard or soft qualities are desiderated. The prepared "rods" are then put into cedar cases, on which quality is indicated by letters, such as "B" for black; "H" for hard; "S. T." for soft streak, &c. Black lead pencils of an inferior quality are made from graphite dust mixed with melted sulphur and run into moulds, those used by carpenters being mixed with tallow to give them softness. Coloured pencils are made from appropriate mineral matters mixed with clay.

The graphite in Borrowdale was found in the primitive rocks in pockets or nests, and so in Ceylon very large masses of pure plumbago, over a quarter of a ton in weight, have been dug out of our crystalline rocks perfectly free from all impurities, with no particles of iron pyrites, gneiss, or of the beautifully white and transparent quartz with which the black mineral is so generally associated. But here, as in India, the United States, Canada, and other countries, graphite is also

found in particles of greater or lesser size diffused through the including rock, whence it has to be separated by careful and costly processes of breaking, picking, washing, drying, sifting, and sorting. The wet process applied to plumbago means that rock impregnated with the ore is pounded and put into water, when the low specific gravity of the graphite (only twice the weight of water) causes it to float. Graphite, as already noticed, has been found in a large number of places in India, but always in too close intermixture with the siliceous, ferruginous, or other constituents of the rocks to be economically valuable.

The Canadian and United States plumbago is of as pure a quality as that of Ceylon, but good as the American ore is, when freed from the rock in which it is generally scattered after the fashion of mica, I suspect the high cost of the labour necessary for first mining and then separating the mineral by the wet process—for the dry has proved a failure—will prevent continued and successful competition with Ceylon. We shall soon see, however, for The Joseph Dixon Crucible Company had produced in 1882 a quarter of a million pounds of native plumbago, against 16,000,000 pounds imported from Ceylon, and a determination to "go ahead" was expressed. Some as yet unthought of machinery, cheap chemicals, and appliances must, however, be brought into play before the pure, massive Ceylon product and our far cheaper labour are distanced in the race. And if, as Professor Dawson states, some of the Canadian ore is fibrous enough to indicate by its texture its vegetable origin, there is room to suspect that, however pure the mineral may be as carbon, its mechanical condition cannot be so good as that of the more highly crystallized Ceylon plumbago. One important element in the question is, that according to our American friends themselves, enterprise and competition have had such influence, that Ceylon plumbago can now be obtained by them at 25 per cent. of what it cost some years ago.

The effect of competing demand for the substance, however, between 1850 and 1870, chiefly on the part of the Battersea Crucible Company in England and The Joseph Dixon Company in the United States, was to enhance the value of the

ore to such an extent in Ceylon as to produce temptations to cheating, which the native headmen, whose business it was to weigh the output and collect the royalty at the pit's mouth, were unable to resist. These estimable servants of Government cheated the diggers out of bribes by threatening to report them as having surreptitiously removed plumbago on which royalty had not been paid, and they impartially cheated Government by accepting bribes to largely under-report the quantities really dug and removed. The Customs figures enabled the Government authorities to appreciate the vast extent to which the demoralizing system had gone, and so in 1873 legislation was initiated, the main object of which was the collection of the royalty at the custom-house—a mode in itself far preferable to the direct system of collection previously in force, and securing every sixpence of royalty due because, practically, every hundredweight dug is exported, the quantity as yet used in local foundries or for any local purpose being quite insignificant. I believe a few crucibles for gold and silversmiths' use are locally made, and the result of inquiries made by Mr. W. P. Ranesinghe, at my request, is that Ceylon potters occasionally employ the mineral for giving a glaze to pottery, as is the practice in India.

The mercantile community strove hard in 1873 to make out a case for the entire abandonment of the royalty, but the Press supported Sir William Gregory's Government in resisting the pressure brought to bear in this direction, only that the *Observer* strongly urged a rate so low as Rs. 5 per ton, which after four years' experience of Rs. 10 per ton, under which exports declined, was conceded in 1877. Under this rate, which is still in force, the exports more than trebled in the six years between 1878 and 1883.

As Government in making grants of land has always reserved royalties on minerals and metals, of course the plumbago dug from private lands paid royalty when exported equally with that taken from rented Crown lands. There was a singular exception in the case of some plumbago lands sold in the district of Kurunẹgala without any reserve, which lands subsequently gave unprecedented yields of very fine plumbago. When it was determined to levy royalty on all plumbago exported, the Kurunẹgala purchasers

claimed compensation, which was awarded them. The result in the case of Mr. Jacob De Mel, who had paid £450 for four acres of land, was that he received all his money back except £5.

Mr. De Mel has been amongst the most prosperous of all who have engaged in the plumbago digging enterprise in Ceylon, his prosperity being mainly due to the rich yield of his Kurunẹgala district mine, which is by far the most important in Ceylon, having been sunk to a depth of 450 feet near the base of a hill, Polgolla, which seems to be largely composed of fine quality plumbago. From this mine Mr. De Mel obtained an average of 800 tons annually for eleven years, his profits, he authorizes me to say, being at the rate of £2,000 per annum. No wonder if, notwithstanding lessened production and profits in the past two years, connected with this mine there is a steam crane for raising water and a considerable length of Decauville railway for the carriage of the ore from pit mouth to cart, or that the enterprising owner has commenced a base level tunnel at an estimated total cost of £2,000 to free and keep the mine free of water, whether the result of springs in the rocks or of monsoon rains. The effect of the latter during the recent exceptionally heavy burst of the South-West monsoon in May was to fill up the pits and put a stop to digging everywhere. This, irrespective of a fall of £2 per ton from the price to which the mineral had been sent up by the war scare.

The tunnel in Mr. De Mel's mine, when completed, will not only carry away water, but facilitate the output of mineral from the lower, which are generally the richer strata, besides ventilating the mine so as to prevent injury from mephitic gases or inconvenience from the smoke of the explosives employed in blasting. The draft will also alleviate the heat in the interior of the mine, which the workmen now complain of as sometimes intolerable. For blasts under water large quantities of dynamite cartridges are employed, in addition to gunpowder used in portions of the galleries comparatively free from moisture. The wages paid to diggers in this mine, chiefly low-country Siṇhalese, vary from 9*d.* per diem for coolies to Rs. 1 for those who perform the boring and blasting operations. In the Pasdun Kóralé there is a system of payment for labour by shares in

the profits, after all preliminary expenses defrayed by the capitalist have been reimbursed.

The hill in which Mr. De Mel's mine has been opened—Mr. W. A. Fernando having another at a higher elevation than De Mel's, with a depth of 330 feet—seems to be permeated in its whole extent by generally horizontal veins of the richest plumbago, associated with beautifully snow-white crystalline to semi-opaque quartz, the latter occasionally showing specks of garnet and bands of soapstone, and Mr. De Mel brings to the surface practically pure plumbago. As regards the generality of pits, he agrees with the estimate of Mr. W. W. Mitchell (who has probably purchased, prepared and shipped to America as well as Europe, more plumbago than any European merchant who ever resided in Ceylon) that the extraneous matter in the shape of earth and rock brought to the pit's mouth is equal to one-half of the whole, about 10 to 15 per cent. being the proportion carried to Colombo and separated from the ore in the preparing yards. Mr. Fernando's estimate, however, of foreign matter brought to Colombo, is 5 per cent. for pieces of quartz round which plumbago adheres, and 2½ per cent. for minute fragments of silica, iron, &c., mixed with the smaller pieces and dust. Any person who has witnessed and appreciated the difficulty and the expensiveness of the processes whereby small fragments of rock are separated from the lower classes of plumbago in Ceylon, can well imagine the obstacles to profitable separation of the mineral from rock in America where there are no masses, but only scales of the mineral distributed throughout the rock.

When the Prince of Wales was in Colombo in 1870, Mr. De Mel exhibited what I suppose was the largest mass of pure plumbago ever shown in this or any other country, its weight being only 14 lb. short of 6. cwt. For this unique specimen a sum of £50 was offered. It was subsequently sent to the United States, and is understood to have been placed in the Philadelphia Exhibition, and finally in an American Museum. Finds of plumbago in large masses do not, however, always prove profitable, such masses being sometimes, although pure carbon, of such a rocky-hard consistency, that they resist the best tempered saws and yield with

difficulty to hammers and axes. Such masses are of course proportionally difficult to grind for use in the manufacture of crucibles and other articles, and do not realize the prices paid for lumps which are soft as well as large. Dulness of colour as well as hardness of texture, decrease the value of plumbago, even where iron may not be present, brilliancy of crystallization being generally an index of a correspondingly good quality.

In legislating for and discussing the subject in 1873, it was announced by Governor Sir W. H. Gregory, that no lands known or supposed to contain plumbago in quantity should in future be sold, for the reason that a few rich men might thus monopolize a pursuit, the benefits of which Government properly wished to see diffused amongst the population. Only leases, therefore, are generally granted, on terms easy for the lessees and fair to the community, of whom Government were the trustees. The Government Agent of the Western Province is now, however, in favour of selling plumbago lands in small lots. Instead of a system exclusively of fees, which would have to be paid whether the land taken up was productive or barren, the rules for leases in force in the Western Province, but, strangely enough, not in the Southern (the mines in the North-Western Province being all on private lands), are embodied in the following memorandum, which I owe to the courtesy of the Hon. Mr. Saunders :—

"When a person wishes to dig for plumbago in a Crown land, he is required to make application in writing to the Government Agent or Assistant Government Agent, who forwards the application to the Mudaliyár of the district for report as to whether the land is such as might be properly leased, and the applicant a proper and fit person to be granted a lease. If the report be satisfactory, the applicant is required to mark the boundaries of the land he wishes for, by trenches and stones, in such a way as to leave no doubt of the exact land selected. A lease bond is then entered into on a stamp of Rs. 10. An extent of one acre only is leased at one time, and only for one year ; but the lease is extended from year to year if applied for by the lessee.

"Instead of charging a fixed sum for [the rent equivalent of] an annual lease, it has been found better to take one-tenth of the plumbago dug.

"No plumbago can be removed without a pass from the headman. When the lessee has a sufficient quantity dug and ready for removal, he applies for a permit. The headman reports the amount and the value of the plumbago so dug. The lessee is generally allowed to purchase the Crown share at its assessed value, and one-tenth of the value of the Crown share [or one-hundredth of the whole] is deducted and given to the headman who weighed and valued the plumbago, and the balance is brought to account as rent for the land."

Under this system a sum of Rs. 954·24 was collected in the Western Province in 1884 (a great falling off from nearly Rs. 4,000 in the previous year), the proportions for the various districts being:—Colombo, Rs. 13·72; Ratnapura, Rs. 158·28; Kẹgalla, Rs. 79; Negombo, Rs. 87·99; Kalutara, Rs. 615·25.

An obvious objection to the Western Province system, and one which has been preferred, is that it seems to revive the temptations to which the headmen of 1873 succumbed; but in reply to remarks to this effect, the Government Agent, Western Province, pointed out that only a tithe of the quantity dug on Crown lands is now in question, and that of this Government tenth the headmen receive one-tenth, or one-hundredth of the whole. One-tenth of a ton, if the plumbago were taken at the Custom-house valuation of Rs. 200 per ton, would be Rs. 20 for 2 cwt., or twice the total royalty fixed in 1873. But the Customs valuation is excessive, and as the plumbago is mixed with extraneous matter, and has to bear the cost of carriage and preparation, of course a "spot value" at a much lower rate is calculated for the rent-royalty. Having referred this question to the Government Agent of the Western Province, he states:—

"Your note has reached me on circuit, and I cannot lay my hand on the exact figures; but I am inclined to think that the value of Crown plumbago, dust and lump together, which varies between Rs. 15 and Rs. 120 per ton at the pit's mouth, is on an average about Rs. 70 a ton, and that the Crown royalty is about Rs. 4 or Rs. 5 a ton. So that, whilst private plumbago pays a royalty in shape of Customs duty of Rs. 5 a ton, plumbago dug on Crown land pays in rent and royalty Rs. 9 or Rs. 10. Considering that plumbago dug from Crown land is generally easily got at, and that it is optional with a man at any time to cease paying rent and to acquire the land, I don't think the rent high. We would always rather sell the lands outright than rent them."

In the latter part of this note, Mr. Saunders seems to have lost sight of the policy announced by Sir W. H. Gregory's Government in 1873, viz., that lands containing plumbago were to be leased, not sold, so as to prevent anything like a monopoly. It is lands which have been proved not to contain the mineral in any quantity, or which have been exhausted, we understood, that are sold. It may be, however, that only large lots of plumbago land were intended not to be sold, the prohibition not extending to one-acre lots. [See appendix No. 14.]

The merit of the system, provided the rent-royalty is moderate, is that the lessee of the land pays only and just in proportion to the productiveness of the land he has leased, payment being accepted in money or in kind. At the end of each year the lease can be either renewed or abandoned, and plumbago lands which have been for a certain time abandoned, and which evidently do not contain appreciable quantities of the metal, are sold on the terms applied to ordinary Crown lands. Copies of an application to dig, and of a lease granted by the Government Agent of the Western Province, are appended to this paper. From the terms of the lease it will be seen that timber for props, &c., can be obtained by the lessee from Crown land at a fair cost, and that roads, paths, &c., can be used for purposes of the mine. The effect of the different systems in operation in the Western and Southern Provinces becomes apparent from a glance at the table of plumbago revenue contributed by each, which is given as an appendix to this paper. Previously to 1881 the contributions of the two Provinces, apart from Customs collections, was pretty equal, but while in 1883 the plumbago revenue (mainly rent-royalty) of the Western Province was no less than Rs. 3,987, that of the Southern Province, derived solely from 74 licenses to dig issued at Rs. 10 each (no rent being charged), was only Rs. 740.

Exaggerated figures have sometimes appeared in the Blue Books, as representing the total number of plumbago mines in Ceylon, from the inclusion of large numbers of abandoned pits. Many such pits are doubtless subsequently worked, so that it is difficult to get even an approximate estimate of the mines existing in Ceylon, and such information, if

attainable, would not help us much, because mere numbers would not distinguish between holes of a few feet deep and Mr. Jacob De Mel's great mine in the Kurunẹgala district, already described. Some years ago there was an account of a mine on a large scale opened for a Mr. Mathew by a European miner in the district of Kẹgalla, and many years ago a couple of North of England men, brothers named Sims, tried their luck in mining plumbago, but without success. What are called mines are generally, however, vertical holes, and the great trouble of the miners, as it is also of the gem-diggers, is to keep out water or get rid of it. Steam machinery has been on a few rare occasions resorted to, and in one instance it has been stated that owing to a deficiency of hose sent out, the primitive means in use amongst the natives of baling by buckets had to be reverted to in supersession of the steam engine. From the Government Agent of the Southern Province I have received a translation of a Siṇhalese description of a plumbago mine, illustrated by a diagram, which is printed as an appendix, and will be found curious and interesting.

As a general rule, graphite seems to exist not far from the surface, on which its presence may be revealed through fissures, while in regard to this mineral as well as gold and other ores, indications in streams guide explorers up to the including rocks, generally quartzy gneiss, in which the mineral is embedded or diffused. Mr. De Mel tells me that very good plumbago is often found near the surface, but that, as a general rule, the lower the digging operations go, the better the quality and the larger the quantity of the mineral. I remember once at Baddégama, near Galle, seeing in a rice field what looked like a large gneiss boulder, the top of which had been blasted away, the process revealing a "pocket" of plumbago. As a general rule, the mineral runs in long thin horizontal veins through the quartzy strata of the gneiss, but downward veins are not uncommon. Of course the purer the finds are, and the larger the masses the better, but a visit to any of the preparing yards in Colombo will show that besides the cost of prospecting and mining and the uncertainty of ultimate success, a good deal of expense is involved in conveying a

considerable proportion (already noticed) of extraneous matter to Colombo, there to be hammered, cut with small axes, picked, sifted, and washed out.

Still, with all its drawbacks, the plumbago enterprise is valuable to the country not only for the revenue it yields, but for the generally remunerative employment it has given to many thousands of the population (from 10,000 to 20,000 men, women, and children, probably, including cartmen and carpenters), especially since the period when the collapse of the once great coffee interest led to so much distress in the country. The Kurunẹgala Administration Report of 1873 stated that in that district alone the plumbago industry had given employment to some 5,000 persons. The Galle report for 1872 estimated that each mine required from two to eight or ten miners, and even up to fifty or sixty, at high wages. The Kurunẹgala report for 1875 mentioned that all the plumbago which had been dug, the figure being given at 2,567 tons, had been removed by rail, coming on the railway at Polgahawela of course. As the principal mines are 18 miles from Kurunẹgala with 12 miles additional to the railway, the expense of cartage for so heavy an article must be very considerable. We cannot be surprised, therefore, to hear that at a period when the plumbago industry was at the height of its prosperity, Mr. De Mel and other mine owners had almost concluded an arrangement with Messrs. John Walker & Co. for a light railway line from the mine region to the Government railway. Depression in prices caused this design to fall through, but the day cannot be far distant when Kurunẹgala at least will be connected with the Government railway system at Polgahawela, forty-five miles from Colombo. The Western Province plumbago found in the Pasdun Kóralé (a kóralé which is famous for the quality as well as the quantity of ore it produces) does not come on the railway at Kalutara. Once it is loaded in boats it comes by water all the way to Colombo.

A return furnished by Mr. Pearce shows that nearly one-half of all the plumbago exported from Ceylon comes on the railway at various points, mainly at Polgahawela, the quantity so carried in 1882 being no less than 5,642 tons. Small quantities come from points so distant as

Náwalapiṭiya, 87 miles, and Mátalé 91 miles from Colombo. Most of the plumbago dug in the Southern Province, and perhaps some from places ranked in the Western Province, are shipped at Galle. Of the total exports from the Island, an average of 12,000 tons annually for the past five years, less than one-tenth goes from Galle; the rest enters into the export trade of Colombo.

To show the vicissitudes of the plumbago enterprise, I may quote from the Sabaragamuwa report of 1873 to the effect that plumbago, which formerly sold at Rs. 200 per ton, then realized only Rs. 90, while the working expenses had considerably increased in consequence of the enhanced prices of labour. It will be remembered that 1873 was the year in which the change was made to the collection of royalty at the Custom-house, in anticipation of which the great manufactories in Britain and America had provided themselves with stocks of the mineral. Hence a fall in exports and prices. Eleven years subsequently, in 1883, Ceylon sent away her largest export of plumbago, but the depression had even then set in, which led to greatly reduced shipments in 1884. In the one matter of cask-making, however, the increase in the export of plumbago during the past five years must have largely filled up the void created by the decrease in coffee. Hora, one of our most inferior timbers, can be utilized for plumbago casks, and as the casks are uniformly made to hold a quantity somewhat over a quarter of a ton ($5\frac{1}{4}$ cwt. nett), an average of 45,000 casks per annum for the past five years, or a total in the quinquennium of 225,000, must have given, in their manufacture, remunerative employment to a considerable number of carpenters who had previously been largely dependent on cask-making for coffee.

But to revert to the subject of plumbago mines. They seem to have been until a comparatively recent period, practically confined to the Western and Southern Provinces, the quantity of plumbago dug in the Central Province being insignificant, and the industry now so wonderfully successful in the North-Western Province being apparently of quite recent origin. In a memorandum furnished to me by Mr. C. Dickman, Assistant Auditor-General, I find the remark that no collections on account of plumbago were made

in this Province until 1872, when Rs. 60 were received; in 1873, Rs. 1,966; in 1874, Rs. 210. There the record ends, and it rather looks as if the money had been received for lands sold, for I have it on good authority that all the mines now worked in the Kurunégala district are on private property; my informant, Gate Mudaliyár Jayatilleke, adds in reply to my queries as to whether there was anything hereditary, or a system of payment by shares amongst the mining class :—

"All the plumbago quarries that are now worked in the district are purchased from the Crown. No licenses have ever been applied for or granted to dig plumbago. The diggers are paid wages, and they are coolies from the Siyanė and Hápiṭigam Kóralés, in the Western Province. Very few Kandyans are employed, as they are not handy in blasting and excavating any depth of more than 15 or 20 feet."

I may add that but few Tamils are employed in the Ceylon plumbago mines, which are, I believe, exclusively owned by Sinhalese, although no doubt the ubiquitous Chetty of Southern India is interested in the recovery of advances made or supplies furnished in some cases.

To Mr. G. S. Williams, the Acting Government Agent of the North-Western Province, I had previously been indebted for responses to my questions, thus :—

"The pits are about sixteen miles north-east of Kurunégala on the Dambulla road. There is a good resthouse at about the 12th mile, and the journey in decent weather is easy enough.

"The trade altogether failed last year—I mean no digging was done—on account of the fall in price, but this year operations have been resumed, and I am told that about 2,000 men are employed. The plumbago is found in rocky ground in which are very large crystals transparent like Derbyshire spar.* De Mel is the owner of the principal pit. The resthouse is at Gókerella. It is not mentioned in Fyers' Itinerary, but is between Polgolla (about a mile beyond it) and Ambanpola. On page 20 of the new edition (1881) Part I., you will find Weṭakeyyápota, which is 15·55 miles from Kurunégala and 0·55 mile beyond that, or 16·10 from Kurunégala, 'minor road to plumbago pit on right.' There are other plumbago pits, some actually by the roadside."

* Crystalline quartsz, of course, as lime taking the form of spar seems to be non-existent in Ceylon?

It thus appears that the best deposits of plumbago at present worked in Ceylon are situated at the foot of the north-western portion of the mountain zone. The mineral exists at high elevations, up to Nuwara Eliya indeed, but apparently not in paying form or quantity. It would appear that while the veins of plumbago run generally from south to north in the Western Province, their direction in the Kurunégala District are from east to west.

In the Central Province as now constituted, few plumbago mines seem to have been opened. The mineral must be rare in the North-Central Province, and still rarer, if really existent, in the Northern Province. Plumbago mining, in any case, seems to be, at present, practically confined to the North-Western, Western, and Southern Provinces, and a Sessional Paper, issued with reference to the legislation of 1873, stated that the number of pits then was altogether no less than 1,779, of which 1,181 were on Crown land, 539 on private land, and 59 on land specially exempted. Of the pits enumerated, 1,086 were in the Western Province, 644 in the Southern, and 82 in the North-Western. In the Western and Southern Provinces by far the larger proportion of the mines were on Government land, there being none on Government land in the North-Western Province. Of the 1,779 mines enumerated, more than half were represented as having been abandoned. In dealing with the question of mines in the "Ceylon Directory" of 1880, the compiler stated that it was impossible to obtain the exact number of plumbago mines in Ceylon, but that it was usually reckoned at about 400, besides 230 gem pits and 30 iron quarries.

It seems possible that if digging for gems and plumbago continues on a large scale, and becomes widespread, legislation may be needed such as exists regarding the protection of wells, and that measures to prevent accidents from subterraneous blasting and the collapse of tunnels, as also to secure free ventilation, may be necessary. Though not so much so as gem-digging, plumbago mining is, no doubt, largely a speculative pursuit, involving the loss and demoralization which ever accompany gambling pursuits. The ultimate result is, however, beneficial to the people and the country.

From some of the Administration Reports consulted, it would seem that the plumbago industry is a recent one in

the district of Sabaragamuwa, although the existence of the mineral must, surely, have been revealed to the gem-diggers who have for ages been engaged in searching for the sapphires and rubies for which the region around "the city of gems" (Ratnapura) is so famous. After adverting to gold, the report of 1868 stated: "A more remunerative speculation than gold-digging has sprung up during the year, viz., the digging of plumbago or graphite, which has been found in a very pure form and in some abundance in nearly every division of the district." In the report for 1869 disappointment was expressed that the demand was not brisker, but strong adverse reasons were suggested in the case of so bulky an article "in the distance from and costliness of the carriage to the stores in Colombo." As regards Kurunẹgala, too, the report for 1875 speaks of plumbago being found at Mipitiya, about 18 miles north-west of the capital of the Province, as if the discovery had only recently been made.

Under the rules now in force royalty is levied on plumbago, the produce of all lands, private or public, all special exemptions being abolished, but of course the owners of private lands are not bound to apply or pay for licenses to dig, nor is any plumbago or its money value in the shape of rent exacted from them, only the royalty collected at the Customs. A vivid idea will be formed of the extent to which Government—that is, the public—were formerly cheated under the system of collecting the royalty at the pit's mouth, when it is mentioned that while cwt. 226,000 were exported in 1869, the royalty recovered was only Rs. 16,000, against Rs. 65,000 on cwt. 263,000 in 1883, the rate in the latter year being only one-third of that in the former.* The extreme rate of 30*s.* per ton in 1869 evidently proved an irresistible temptation to diggers and headmen, and the royalty recovered was only one-tenth of the sum which

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* How striking is the illustration here afforded of the value of indirect (and especially Customs) taxation, rather than a direct levy in the case of Orientals. No greater fiscal boon could probably be conferred on the people of India and Ceylon than—if it were possible—the collection of all Government dues through the Customs Department, so saving an amount of oppression on the one hand, and of bribery and corruption on the other, of which European administrators never get more than a faint idea.

ought to have been collected. No wonder if from 1869, until the new system came into play, Government had to confiscate considerable portions of the mineral, or that Sir W. H. Gregory in closing the session for 1873 should have remarked: "The Plumbago Ordinance will, I firmly believe, give a great impetus to mining enterprise throughout the country, and put an end to the widespread fraud and demoralization which the present system entails." Fraud and demoralization were at once checked, but the anticipated impetus to mining enterprise was only fully given when the royalty was reduced from Rs. 10 per ton to Rs. 5, in 1877. The criterion, I need scarcely say, is not to be found in Blue Book returns of the number of mines open or dormant, but in the figures of the Custom-house.

In the Blue Book for 1884 the figures given for plumbago mines are 81 in 1884 against 246 in 1883, in both cases exclusive of mines in the Southern Province, whence returns of mines seem not to have been sent, the details for 1884 giving 57 mines in the Western Province and 24 in the North-Western. I find, however, that in the Southern Province the licenses to dig plumbago issued in 1883 were 74, falling to 10 in 1884. From the North-Western Province estimates are given in the Blue Book, which are manifestly imperfect, the figures for 1884 being 1,500 tons of mineral valued at only Rs. 150,000. The addition of the mines open in the Southern Province would doubtless bring the number of plumbago mines at work in the year of reaction and depression (1884) up to considerably over 100, a number which will, probably, be doubled or trebled, should rumours of and preparations for war give a fresh impetus to the pursuit. Although no estimate of the number of mines in the Southern Province is attempted, the Blue Book return mentions: "Plumbago and iron mines; gems and minerals in small quantities are taken from rivulets and the surface of the earth in numerous places;" and the curious statement follows: "Plumbago about 65 tons, valued at from Rs. 20 to Rs. 100 per ton." We may safely assume that the figures for quantity and value are equally inadequate. Indeed, the Customs returns of revenue show that 753 tons were exported from Galle in 1884. It was natural that the mineral should be valued at a low figure in

1884 in view of the depression which prevailed, and which is vividly represented by the comparative figures for the totals for the Island of ten-rupee license fees to dig on Government ground for 1883 and 1884, which, with (in the Western Province) rent of 10 per cent. of the yield, gave Rs. 4,736 for the former year and only Rs. 1,054 for the latter, a falling-off equal to Rs. 3,682, representing probably a deficiency of a couple of hundreds in the licenses applied for and granted last year as compared with 1883.

As has been proposed in the case of chips in the cinnamon trade, it would almost seem desirable that low quality dust should be excluded from the exports. Buyers are strongly inclined to confine their attention to lump of best quality, and I have heard that some of the local dealers have injured their own reputation, and that of the article in which they deal, by mixing lower qualities with the higher. As matters stand, the proportions in which the mineral seems to be exported are :—lumps, 1st and 2nd quality, 50 per cent. ; chips and dust, each 25 per cent. ; so that dust is only one-fourth of the whole. In the home market during the past five years of unprecedented outturn, I am informed that prices have ranged from £20 per ton, the highest for lump, down to £10. In Colombo, apart from the exceptional case in the experience of Mr. W. A. Fernando, already mentioned, the highest prices ever known are stated to be Rs. 320 per ton for fine, Rs. 270 for ordinary, Rs. 95 for dust. In the old sailing ship days plumbago was taken at an exceptionally low rate of freight as "dead weight." Since 1880 the average rates for a ton of 20 cwt. have been :—steamer 40*s*. ; sailer 35*s*.

The United States are our best customers in the case of plumbago, the Ceylon form of which the late Mr. Joseph Dixon saw and appreciated in 1827, and of which he secured a first shipment in 1829. In 1882 the quantity received in the United States from Ceylon was stated at 16,000,000 lb., and of the *comparatively* small quantity of $22\frac{1}{4}$ millions of pounds sent from Ceylon in 1884, more than half went to the United States. But a memorandum showing the various countries for which the plumbago exported in the past five years was destined, will clearly indicate how important a customer for our mineral we have in the United States with its large steel manufacturing

industry. Besides the quantities which may subsequently have been transhipped thereto from Britain, the direct shipments for the United States from Ceylon were 133,000 cwt. out of a total of 205,000 in 1880; 160,000 from 260,000 in 1881; 113,000 from 260,000 in 1882; 141,000 out of 262,000 in 1883, and 94,000 out of the total of 182,000 in 1884. The general result is that of the whole export of 1,170,000 cwt. in the five years, 641,000 (or very considerably more than one-half of the whole) went to the United States, the United Kingdom taking the bulk of the remaining 529,000 cwt. How far the continent of Europe may draw on Britain for supplies of graphite, I am not aware, but the shipments of plumbago from Ceylon diverted in the past five years to other ports than those of the United States and the United Kingdom have not been important. To Trieste went 4,217 cwt. in 1881; to Hamburg 4,031 in 1881; to British India 1,095 in 1880; to France 884 in 1884; to Holland 945 in 1884; to Australia 885 in 1881; and to Hongkong 739 in 1883. But for all practical purposes we may regard Great Britain and the United States as taking at first hand the whole of the plumbago Ceylon produces. Out of an export of 263,000 cwt. in 1883, Britain took 119,000 and the United States 142,000, leaving only 3,000 cwt. for all other places. The memorandum referred to is appended as a note.* It seems probable that three-fourths of all the

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* Plumbago exported in each of the last five years, showing the countries to which the mineral was shipped:—

	1880.	1881.	1882.	1883.	1884.
	cwt.	cwt.	cwt.	cwt.	cwt.
United Kingdom	70,276	89,709	143,450	119,312	84,981
Holland ...	—	—	—	438	945
Trieste ...	107	4,217	1,828	—	210
France ...	507	699	300	294	884
Hamburg ...	—	4,031	—	—	816
U. S. of America	133,556	160,259	113,451	141,664	94,083
British India ...	1,095	109	999	326	506
Australia ...	197	885	118	—	—
China ...	—	—	12	—	—
Hongkong ...	—	—	8	739	—
Total ...	205,738	259,909	260,166	262,773	182,425

plumbago which Ceylon exports is used in the great crucible factories of Britain and the United States, that established by the Messrs. Morgan Bros. at Battersea and the crucible factories of Jersey City, New Jersey.

Both establishments are on a very large scale, and afford remunerative employment to a considerable number of operatives. Mr. O. V. Morgan, the principal partner in the English Company, will be a candidate for Battersea at the forthcoming Parliamentary election, and will pretty certainly be chosen. He is a gentleman of high character, intelligence, and enterprise, and has travelled much, including a visit to Ceylon. His firm, that of Morgan Brothers, besides their manufacturing and banking pursuits, turned their attention to periodical literature, having founded the *European Mail* and the *British Trade Journal.* Mr. Morgan has taken an active part in general social improvements, and has done a great deal to secure the well-being of the operatives at the extensive crucible works, which he and the brother next to him in age founded in 1855. The American establishment had been at work long before this period, but no doubt its productions did not go beyond local demand, for in a notice of the Battersea works we find it stated that previously to 1855 crucibles were almost exclusively imported from Germany. Now that country, together with other centres of industry on the continent, is principally supplied from Battersea, where crucibles are turned out at from 8*d.* per dozen, up to a gigantic melting pot costing £6 5*s.*, and capable of taking in 1,000 lb. of steel. Such a crucible can bear from 8 to 10 meltings, while in the case of gold a crucible taking in 1,200 ounces can sometimes stand seventy meltings. So in the case of brass, while crucibles for assaying the precious metals are very carefully manufactured, being rendered porous by the use of charcoal. The proportions of graphite and fire-clay used in crucibles for various purposes differ widely no doubt, but good serviceable melting pots contain from 25 to 50 per cent. of graphite, the proportion of graphite being, we may take it for granted, larger in crucibles used in mints. The absence of coal fuel from Ceylon is probably a fatal objection to local iron or steel manufacture on any extended scale, but for small quantities of superior steel for special local use, I would, with some diffidence,

suggest that crucibles composed of our indigenous plumbago and kaolin clay, both abundant and cheap, might be profitably used. The existence of "millions of tons" of iron ore in Ceylon is not so apocryphal as that of anthracite, and those who owe their origin to Britain are not likely to forget that her wealth in iron quite casts into the shade all the treasures of the diamond mines of Golconda and the gold diggings of California and Australia.

But to return to the Battersea works. Messrs. Morgan Bros. get credit for a liberal and sensible scheme of pensions for their workmen, while to some extent the men have a share in the profits of the firm. Although the plumbago sent from Ceylon is carefully prepared and assorted before being packed for shipment, it yet appears, from a description of the Battersea Patent Crucible Company's works contributed to the *Chemist and Druggist* by Mr. J. C. Brough, that, preparatory to grinding and manufacture, there is a careful process of selection. Mr. Brough stated :—

"The graphite imported by the Company is not used solely in the manufacture of melting-pots and metallurgical apparatus. A good proportion of this valuable raw material is prepared for domestic purposes, and sent from the Battersea works in the form of ordinary 'black lead.' As this article is used wherever there is a grate or stove to be kept bright, its annual consumption must be very large. There is no substitute for it—nothing that can be employed in the same way to polish and protect the ironwork of common fireplaces. Without the factitious lustre produced by the action of 'elbow grease' on black lead, the most elaborate kitchen range would soon become unsightly, the trim parlour grate blush with rust, and the cottager's 'wee bit ingle' would leave off 'blinkin' bonnily.'

"The various qualities of black lead which the Company sends into the market under different fanciful names are all prepared from graphite or plumbago, and nothing else. The highest qualities are distinguished from lower by their superior fineness, softness, and lustre ; but chemically they are identical. The article sold under the sentimental name of 'Servants' Friend' at 28*s*. per cwt. is quite as pure as the 'Prize Medal Lustre,' which fetches double the price, or 'Halse's Roman Lustre,' the best quality of black lead manufactured by the Company. Again, the analytical chemist would fail to detect any essential difference between either of the abovenamed products and the article labelled

'carburet of iron,' in remembrance of an exploded opinion respecting the nature of graphite. How comes it, then, that one quality is so much superior to another? The explanation is simple enough. The difference in the manufactured article may be traced to certain variations in the physical properties of the raw material. Thus, one sample of graphite may be soft and lustrous, while another, equally pure, may be hard and dull. These variations are subordinate to the distinction between amorphous and crystallized graphite, which we referred to when describing the stores of raw material. For making domestic black lead, the amorphous or soft graphite is almost exclusively used.

"The separation of the different qualities of graphite is a labour which demands great experience and judgment, and can only be successfully performed by the old hands. The best pieces are soft and unctuous, perfectly free from grit, and capable of receiving a very high polish. The worst pieces, technically called 'gruffs,' are, on the contrary, harsh, gritty, and deficient in lustre. The latter are only employed for making 'leads' of the lowest brands. The numerous intermediate qualities are distinguished one from another by characters which are only apparent to the experienced eye.

"The manufacture of black leads includes three distinct operations—grinding, sifting, and packing. At the Battersea works, the first operation is performed by means of a large mill driven by steam power. The ground 'lead' is conveyed to an upper floor by an endless-band elevator, and is then sifted through the finest silk by a contrivance resembling an ordinary dressing machine for flour. The packing is chiefly done by boys, who work with marvellous rapidity. The powdered black leads are done up in neat packets in quantities from two ounces upwards; they are also packed in 1-lb. tin canisters and in wood boxes. Papers of various colours are used to form the small packets, so that the different qualities may be readily distinguished. A paper covered on one side with burnished black lead is employed for wrapping up some of the higher qualities.

"Two descriptions of 'blocked black lead' are manufactured by the Company. The blocks are formed by pressing the powdered and sifted graphite into suitable moulds by the aid of machinery very similar in construction to that employed for making bricks, though, of course, on a much smaller scale. There are two blocking-machines constantly at work, and the number of little bricks they turn out annually would amply suffice for the building of a Liliputian city. * * * *

"Crucibles have been in use for melting and refining metals from that distant point of time when man exchanged his stone hatchet and bone chisel for implements of bronze. The earliest melting-pots were doubtless made of the plastic and infusible substance, clay, and there is no reason to suppose that they differed essentially from the earthen crucibles now commonly used in our foundries.

"The works of the Patent Plumbago Crucible Company cover a large space of ground at Battersea, and have good river frontage. As we proceed along the lane which leads from near Battersea-bridge, we find that the ground gets blacker and blacker, and before we reach the threshold of the office we notice the familiar black-lead polish beneath our feet. Passing a regiment of clerks, we enter the private office of the manager of the works, where we put on a very large coat and a very old hat, which are kept for the use of clean visitors. There are many things in this little office which attract our attention. The walls are covered with testimonials from British and foreign mints respecting the excellence of the Company's manufactures, with here and there a prize medal. The International Exhibition of 1862 is recalled, not merely by the prize medals awarded to the Company for crucibles and black leads, but also by the splendid collection of samples of plumbago, which formed such a striking feature in Class I. In this collection every quality of plumbago is represented by specimens from all the most celebrated mines, particularly those of Ceylon, Germany, Spain, Siberia, Canada, Finland, and Borrowdale. We learn from the manager that some of the samples would not be adapted for the manufactures of the Company. The Siberian plumbago, for instance, contains too much iron; and, although this could be entirely removed by the Company's patented process for purifying plumbago, it is found cheaper to work with the Ceylon plumbago, which contains but little iron.

"Before we leave this snug office for the busy factory, we will jot down a few notes on plumbago, or, to use its more correct name, graphite. The old mineralogists, misled by its remarkable metallic lustre, placed graphite among the metals, and at the present time there are doubtless many persons who accept 'black lead' as an appropriate name for this substance. In most dictionaries graphite is defined as 'carburet of iron,' in accordance with the opinion formerly held by most chemists that it was a compound of carbon and iron. This definition is now known to be incorrect; for although iron is generally present in graphite, it

must not be regarded as an essential constituent any more than the silica or alumina which usually accompanies it. The iron, silica, and alumina, when present, are simply in a state of mixture, and not chemically combined. Graphite is one of the forms of carbon, that Protean element which also occurs native as the sparkling diamond and the black and lustrous anthracite, and which also appears in the familiar shapes of charcoal, coke, and lamp-black. According to Dr. Wood's analysis of a sample of the graphite used at these works, it contained upwards of 98 per cent. of pure carbon, the remainder being silica with mere traces of iron and alumina. Few samples have been found to contain less than 95 per cent. The variform character of carbon is exhibited by graphite itself, for it is sometimes crystalline and sometimes amorphous. The crystallised, or foliated graphite, is found occasionally in six-sided tabular crystals, but commonly in foliated or granular masses. It is chiefly obtained from Ceylon, where it is found imbedded in quartz. It is also found near Moreton Bay, in Australia ; in the States of New York and Massachusetts ; and in Siberia. The amorphous graphite is that variety to which the terms 'plumbago' and 'black lead' are ordinarily applied. It is much softer than the crystalline graphite, and makes a blacker streak on paper. Formerly it was obtained almost exclusively from Borrowdale in Cumberland, but the mine there is nearly exhausted, and we believe is no longer worked. The bulk of that used at present comes from Germany, principally from Griesbach near Passau. Both varieties are used in the manufactures of the Company—the crystalline for crucibles and the amorphous for polishing powders.

"The consumption of Ceylon graphite at the Battersea works has had an extraordinary effect upon the price of the article. When the Company commenced business it cost about 10*l.* per ton, but now (1864) it cannot be bought at double that price.

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"The total quantity of graphite exported from Ceylon in 1862 was 40,895 cwt., of which no less than 34,730 cwt. was shipped to Great Britain. The Customs returns for last year have not reached us. We do not wish to be understood that the Patent Plumbago Crucible Company use up all the Ceylon graphite brought to the United Kingdom, but it is well known that they are the principal consumers. We must now take leave of chemistry and statistics, and see what there is to be seen at the Black Potteries.

"We commence our tour of inspection at the Receiving Stores, where we are shown the stock of raw material, which comprises

at present about 2,000 casks of graphite, each one holding from four to five cwt. The heads of a couple of casks are broken open in order that we may compare the hard iron-grey fragments of the Ceylon graphite with the black, dull, friable lumps of the German variety. A piece of the latter pressed between the finger and thumb feels pleasantly soft, and flattens readily into a lustrous cake. From the stores we pass to the engine-house to take a peep at the prime mover of the machinery employed on the factory. One horizontal engine of 25-horse-power serves to do all the work that does not require skilled hands.

"The organisation of labour is thoroughly understood at the Battersea works. There is a place for every man, and every man is in his own place. A strict code of rules is enforced by fines; but these fines are paid over to the Fund of the Workmen's Provident Club. We have been over many great industrial establishments, but have not seen any better managed than this crucible factory."

Let us now turn to the older American Company, which, if we count from Mr. Joseph Dixon's beginnings in 1827, has not been merely thirty years handling plumbago, but for a period of over half a century. Mr. Orestes Cleveland, writing in the *Journal of Applied Science*, some years ago, stated:—

"We (Joseph Dixon Crucible Co., Jersey City) have been forty-five years engaged in the manipulation of plumbago, being the oldest house in the trade in this country, handle more of it now than any other single establishment in the world, and have been successful in its application to different branches of industry; we may, therefore, offer information without being accused of not understanding the subject treated. The black lead of commerce, and what is so called by the trade, in first hands, is found only in Europe, principally in Germany. The plumbago of commerce comes mainly from the island of Ceylon, but is also found in many parts of the United States, being mined successfully, however, only at Ticonderoga, in the State of New York. It is also mined to a small extent in the Ottawa region of Canada, though thus far without profit. It is therefore known in trade as Ceylon plumbago. It is very refractory. I have experimented by subjecting for two hours a piece with sharp projecting angles to a heat that would melt steel, and on cooling found the sharpest points perfect; but it will exhaust if left on top of such a fire. It is found in veins in a pure state, is removed in lumps, and a selection of these

forms the 'prime lump' of commerce. The formation most common in a pure state is that of laminated crystals, elongated at right angles with the side of the vein, if not more than from four to six inches wide ; but when the vein widens the crystallization often radiates from numerous centres, and the whole formation is very beautiful ; the foliated variety is equally valuable and more brilliant, but rare in any quantity ; the acicular form of crystal is not apt to be as pure in the lump, but it is useful for most purposes ; the granulated variety, the purest of all, is of little use for crucibles, but, with suitable manipulation, produces the finest grades for electrotyping and fine lead pencils, and is unequalled for lubricating. Pure plumbago is free from grit when pulverized and rubbed between the fingers, and the polish produced in the same way is instantaneous and very bright, being like a darker shade of polished silver. It is found mixed with iron, rhombspar and other forms of lime, the rock and earth in which the vein is carried, and many other foreign substances injurious for all the purposes for which pure plumbago is needed ; so that much care is necessary in purchasing the raw material for a given purpose. Lime, for instance, is fatal to plumbago for crucible-making. The plumbago is mined in the interior of the island of Ceylon, and is brought down to Colombo in bullock carts. It is there selected into grades ; so much as may be finely broken up is sifted, and the coarser part of this is called 'chips,' while the finer part is called 'dust.' The 'dust' from the prime lump is, of course, very different in character from the dust left from the poorer grades of lump, and all of it, whether lump or dust, after being handled and packed in barrels in Colombo becomes so black and bright by the poor particles rubbing against the good, that the touch of an expert is required to distinguish between the grades. The German black lead is not refractory, and is therefore useless for any purpose that brings it in contact with the fire. It has no value for the crucible-maker, or for stove polish, and is of but little use as a lubricator. It has a very low conducting power, even in its pure state, and the best quality that comes to market is far from pure. None of it comes in its original state as mined, but all of it is washed and floated, and so the grades are produced. In fact, it resembles a weak black clay more nearly than it does true plumbago in nature as well as appearance. It is used often on account of its cheapness, when it would be cheaper to use the real plumbago even at five times the price."

Mr. Cleveland then proceeds to state that the first [first in order of time] and still the most extended use of plumbago

is for making pencils. Originally, lumps of the mineral were cut into the required shape. Then, until the Borrowdale mines gave out, the masses were sawn into thin pieces to be enclosed in wood. And now Mr. Cleveland proceeds to describe, in detail, the process of which, according to the latest edition of the *Encyclopædia Britannica*, M. Conté, of Paris, was the discoverer :—

"The present method consists in selecting the best granulated plumbago (found till recently only in Germany), pulverizing it very finely, and floating it in water through a series of vats ; the coarser particles settle to the bottom of the first vat, the finer in the next, and so on, till, after passing through several, that which settles in the last vat is considered fine enough for the purpose. A suitable clay is found as yet only in Germany, and this is treated by the floating process, the finest only being fit for use. The plumbago and clay are then mixed together with water to the consistency of cream, ground together like grinding paint. When the operation is completed, the mass is plastic, water enough having evaporated to leave it in that state. It is then placed in a press and forced through an opening of the size desired for the pencil leads, and the leads are cut to a suitable length, straightened, and dried. When dry enough to handle, they are placed in a crucible, the air excluded, and subjected to a high heat, which bakes them and brings them out ready to be placed in the cedar for pencils. The different grades are produced by the different mixtures of clay and plumbago ; the more clay, the harder the grade produced. Skill in the manipulation, the exercise of great care as it progresses, and an expert to select the materials, are absolute prerequisites for a perfect product."

It will thus be seen that the finishing process in the manufacture of black lead pencils is baking in a crucible composed, probably, of the same mineral.

In most of the works consulted in the preparation of this paper—and they have been many and various—the credit of having first made and used plumbago crucibles has been given to the Germans. Mr. Cleveland awards the credit to the Dutch, and it is certainly significant that the Dutch name for the mineral should be *potloot*, or pot lead, the lead of which crucibles are made (?)—Mr. Cleveland states (writing some six years ago):—

"*Crucibles or Melting Pots, Retorts, &c.*—Forty years ago the only plumbago crucible was made by the Dutch, the melting

pots used in most countries being made of clay and sand; but the late Mr. Joseph Dixon, the founder of our house, in 1827 made crucibles by using the plumbago found in the State of New Hampshire, of a quality so far superior to the Dutch black lead pots that he took the market from the first. He afterwards saw specimens that had been brought from Ceylon as curiosities by Captains in the India trade; and finding them so much better than the New Hampshire plumbago, he procured a shipment, being the first importation of Ceylon plumbago to the United States. For crucibles the pure lumps known as 'prime lumps' only should be used, ground to a fineness that leaves the particles bright and glistening when held to the light, but not so fine as to destroy this appearance. It is then mixed with clay, and the best known for that purpose is found at Mayence, comes down the Rhine, and is shipped to this country from Rotterdam. A small amount of finely-pulverized charcoal should be added to render the crucible porous. As little clay should be used as will suffice to hold the plumbago together, the object in using the clay being only to cement the particles of plumbago. After a thorough mixture, the crucibles are turned into the desired shape, much the same as potteryware; they are then dried in a kiln like pottery. In use the crucibles should be placed in the fire, and not on it. The fire should surround the crucible to the very top. If used with a blast, the blast should not strike the crucible direct, but there should be coal for the blast to strike against. The crucible should be kept in a dry place, the least dampness being fatal. If they are well made, no annealing is needed, the object of annealing being only to complete the shrinkage that should be fully accomplished in the 'burning' by the crucible-maker. To provide against slight dampness, however, it is well, when possible, to use the crucible for the first time in a new fire, placing the crucible in the furnace at the time of lighting the fire, so that it heats up gradually with its surroundings. After the first time even this precaution is unnecessary. For melting brass, copper, gold, silver, or alloys of metals, a Dixon Plumbago Crucible should run from twenty to forty meltings according to the fuel, draught, care, or other circumstances. I have known them used seventy and even eighty times, with a natural draught and great care. For melting steel, they will run from four to six times. They can be made to run longer by care and a system of cleaning the slag from the surface after each melting, and coating the crucible with a mixture consisting of fire clay, plumbago, charcoal, and silica; pure fine quartz sand being, in my judgment,

the most useful form of silica to employ ; other substances have been used, but these are all that are of any real value. The carbon from the interior of gas retorts would be better than charcoal, but it cannot be had in quantity, and is too hard to pulverize cheaply ; in consequence of that hardness, it is used successfully in electric batteries where a carbon is wanted."

Mr. Cleveland then proceeds to describe the processes by which stove polish is produced, the great point being that the more finely the plumbago is pulverized the better and brighter will be the result, large particles flying off and getting wasted in the process of rubbing. He adds :—

"The polish from pure Ceylon plumbago will last on the iron for a long time, while the polish from the German black lead will burn a reddish brown when the stove is raised to a red heat. But as the German is less than half the price of the Ceylon, it is used with it as an adulteration, and for the cheaper kinds the German is used alone. The Ceylon is adulterated also with coal dust, pulverized slate, and many other substances. Dishonest makers of stove polish have this temptation, that only experts can detect the adulteration ; and they succeed in palming off their mixtures, because the particles of adulteration do not prevent the particles of plumbago from polishing the iron to a small extent. For instance, a thousand particles of adulteration and a thousand particles of plumbago, mixed together, can be sold at a low price, and the particles of plumbago will do the polishing, while most of the particles of adulteration will fly off in the process."

And so our plumbago, like our coffee, suffers from the "ways" that are literally "dark" of the adulterators. Mr. Cleveland, in a kind of despair, exclaims :—"Perhaps no "article except mustard can be so successfully adulterated as "plumbago." He means, of course, for stove polish, because adulteration in the case of plumbago used for crucibles would soon be betrayed in the trial by fire, one great value of the pure plumbago in crucibles being that it conserves carbon in steel when being melted. Mr. Cleveland strongly deprecates liquid stove polish and varnish. Premising that the plumbago should be very finely pulverized, we may, for the benefit perhaps of the owners of stoves or other articles of cast iron in Ceylon, quote the description of the proper mode of application of a substance which is not merely a

bright paint, but the best possible protection of the iron from rusting. Mr. Cleveland states :—

"The proper way to polish a new stove is to mix the plumbago with water to about the consistency of cream, have it in an open dish, apply it to the iron like paint, and with a dry stiff brush polish quickly till dry ; and this polish will be brighter, and last longer, than any varnish polish ; and if the plumbago is right, this method is much more economical in material and labour."

As a lubricant for metal surfaces, journal boxes, carriage axles, and all metal bearings, we can easily understand why only the very finest plumbago should be used, the choicest lumps being pulverized till the particles will not glisten but the mass becomes a dead black. It cannot, Mr. Cleveland states, be made fine enough by bolting (he means sifting through silk), but must be floated either in water or air. He adds :—

"The simplest method is the water separation, and during the process it should be treated to a bath of dilute sulphuric acid, which will take up the particles of spar and iron, leaving the sulphates of lime, magnesia, and iron easily washed out.

"The Dixon lubricating plumbago is pulverized by rolling thirty-two-pound iron balls, and is brought into infinitely fine grains, giving it more body and usefulness than the scale form. There is no purpose for which plumbago should be as pure and as fine as for lubricating, except for electrotyping ; but a large part of that which is offered for sale as a lubricator is adulterated, some of it being composed mainly of the German black lead, and is of no more use than common clay for the purpose. For blowing cylinders the best quality of Ceylon plumbago, pulverized to the finest grade, pure, and left with a good body, is the most economical. For engines, rolling mills, and machine bearings the very finest should always be used. For wood bearings, after oiling with the plumbago a few times, the oil can be dispensed with, and the pure plumbago only applied in the dry powder. For metal bearings it should be freely mixed with oil. On hot axles or journals, apply it freely, dry, and then oil up as usual. If the railroads would all use the best grade of Ceylon plumbago, pulverized and prepared as described, hot journals would be very rare, and much delay and loss in freighting saved, as well as annoyance to passengers avoided. No substance is known that is so useful for lubicrating as plumbago, and yet, although used for that purpose more than two hundred years ago, the true

method of preparing it was not known till within a few years, and it comes upon the market now little understood, and almost like a new material. It is destined to work great changes. Mixtures and quack nostrums are sold with sounding names, but as the plumbago in them is all they contain of the least value, it is better to use it pure."

I notice, however, from advertisements in the American papers, that "mica grease" as a lubricator is competing with plumbago, but how far successfully I cannot say. What I know is that the writer of a recent article on American minerals strongly supports Mr. Cleveland's view as to the great superiority of plumbago as a lubricator. I am not aware that it is so used to any extent in Ceylon, either in foundries or on the railways, although if all stated regarding its value be correct, Ceylon plumbago ought to be much more largely used in Ceylon than it is at present, as a lubricant and for other purposes. For all uses it would seem that grinding to extreme fineness is essential. Mr. Cleveland proceeds :—

"*Electrotyping.*—To the electrotyper absolute purity in his plumbago is a necessity, and hence any adulteration will discover itself at once on trial. The purest selected Ceylon lumps should be treated as described for lubricating, but the separating process should be carried to a finer point, and the acid bath given with care. This acid should be applied till with a thorough stirring no effervescence takes place, or bubbles rise to the surface. In electrotyping the great conducting power of the plumbago asserts itself."

Mr. Cleveland, it will be observed, speaks of plumbago as if it were invariably a good conductor, but another writer on the subject (Smee), who seems to write from experience, says that some lumps are non-conducting, just as some pieces though perfectly pure carbon are so hard as to resist the saw. And now we come to a use for plumbago, scarcely if at all inferior to that of crucible manufacture, viz. :—

Facing for Moulds or Foundry Facings.—For this purpose plumbago is but little understood, although it is used to a limited extent. That it is valuable, most skilful moulders are aware ; consequently, much of the trash that is sold for 'facings' is called plumbago, to make it sell, without containing a particle of

anything even resembling the real mineral. Most of that which is sold to the stove-plate and other smooth-casting foundries for 'black lead,' is innocent ground slate, but some of it is a mixture of ground coal and German black lead, while charcoal would be better than either if ground fine enough. Ceylon plumbago combines the two qualities of a substance almost as refractory as asbestos, and the most perfect conductor of heat. These are the essentials of a perfect 'facing.' It cannot be pretended that any other substance will answer as well, unless it will combine and form a flux upon the surface of the metal. As for the mechanical operation of filling up the pores, or smoothing the mould, plumbago has no equal. For iron castings it need not be a perfectly pure article, but that it be pulverized very fine is absolutely necessary for economical work and the best results."

We now come to some miscellaneous and curious uses to which plumbago is put, the mineral being applied to articles so different as musical instruments, hats and boots, bottles, paint, boats and yachts. Listen:—

"For pianos, plumbago is employed to coat the bridge over which the wires are drawn, because of its perfect lubrication; it prevents the wire from adhering to the wood, and should be as free from impurity as that used by the electrotyper, but need not be pulverized as finely. For organs, it is used to lubricate the sides, and should be the same as that used by piano-makers. The German black lead imparts a peculiar tone to the colours and a softness and smoothness to the touch of felt hats. The very best lump only should be accepted. As it has once been washed and dried in lumps, they will readily separate again in water, and no pulverizing is needed. For colouring dark glass for carboys, bottles, &c., the best German black lead is used in lumps, but no inferior grade will answer. For paint, plumbago has long been known as possessing great value. The elements do not exhaust it, water sheds from it as from oil itself, and fire does not affect it. The grade need not be the highest. For the bottoms of boats and yachts it has long been used, especially for racing boats; but only the best Ceylon plumbago, very finely pulverized, is valuable."

A substance which used, as a paint, resists the action of the atmosphere and is both waterproof and fireproof, is surely of great economic value, and ought to be specially useful as paint for the numerous tea factories erected or in course of erection in Ceylon.

Finally, Mr. Cleveland gives the following information :—

"*For Blast Furnaces.*—Plumbago thrown into the blowing cylinders, if adulterated with coal dust, will be worse than nothing. It should be pure and very fine, so that each particle that strikes the side of the cylinder assists in polishing the surface. The German black lead is of no value, because as many particles of the clay character will stick to the iron as there will be particles of the black lead character to lubricate the iron and render it smooth.

"*Refractory Mixtures.*—For tweers, pointing-up furnaces, &c., take 'prime lump' Ceylon plumbago, pulverized to scales as directed for crucibles. Then mix equal parts of Dutch pipe-clay, fire clay, half the quantity (by measure, not weight) of charcoal, and the same half quantity of silica (pure quartz sand ground fine being the best); to this mixture add as much of the plumbago as possible and leave the mass thin enough to work. It should be made just thin enough with water, so that it will run rather sluggishly. Plumbago for polishing powder should be of the very best quality, finely pulverized. The German black lead is sometimes used, but is not economical for the powder maker, and for high-priced powder is useless. Shot is polished with plumbago, and it should be absolutely pure, pulverized to the finest grade from Ceylon 'prime lump.'"

Mr. Cleveland's very interesting and valuable notices of the American Crucible Company, and their varied manufactures of plumbago, is supplemented and brought down to so late a date as 1883 by the writer (Mr. John A. Walker) of an article on Plumbago in a volume on the "Mineral Resources of the United States," prepared by the National Geological Survey Department, and supplied to our Library by the Smithsonian Institute, to which my attention was attracted by our Honorary Secretary, when he asked me to write this paper. In the summary prefixed to this volume it is stated that the amount of graphite mined in the States in 1882 was 425,000 lb., worth crude at the point of production 34,000 dollars, equivalent to about Rs. 70,000. During the first six months of 1883 the production was estimated at 262,500 lb., worth 21,000 dollars. From Mr. Walker's detailed account we learn that graphite is, as a mineral, widely distributed in the United States; as an ore it is found in but few places in sufficient

quantities and purity to be profitably worked. The terms of Mr. Walker's report apply to India and many other places where plumbago exists over wide areas. In North America it is found in the older rocks of the Appalachian chain, from Alabama to Canada. Its occurrence is said to have been reported in great purity, and in veins from 18 inches to 5 feet thick, in five different localities. If such graphite were abundant, with fairly cheap labour and good means of communication, Ceylon might tremble for her supremacy in this branch of commerce; but we find it added, that of the Eastern deposits those of Pennsylvania, New Jersey, New York, and Canada are of the crystalline or foliated variety, are the best known, and are the only ones which are at present being worked. The amorphous plumbagos found in the Southern States are said to be of such a nature that purification is economically impossible. They can be used only in the crude state, and but for few purposes. The attention being paid to the mineral in America may be judged from the fact that samples had been received and reported on by The Joseph Dixon Crucible Company from no fewer than 33 localities between October, 1877, and January, 1882. Mr. Walker's notice of the "Origin and Characteristics" of the United States graphites, I append as a note.*

Under the heading "Productive Localities" Mr. Walker states :—

"The only place in the United States where graphite is now mined successfully is at Ticonderoga, New York. This property, owned originally by the American Graphite Company, now belongs to The Joseph Dixon Crucible Company, of Jersey City,

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* "*Origin and Characteristics.*—Graphite is now generally conceded to be of organic origin—the result of the metamorphism of some of the products of destructive distillation of vegetable tissue. It occurs in veins, beds, and disseminated through strata (graphitic schists). The veins occur principally in New York, Canada, and the Far West. They are true fissures in gneissoid rock. The vein graphite is usually associated with calcite and quartz. Pyroxene, mica, and apatite are sometimes found with it. Crystals of calcite are found, which on being split show scales of foliated graphite along the planes of cleavage. Graphitic schists are found in the same regions as the

New Jersey. The American Graphite Company worked the vein deposits to a depth of 600 feet. The Dixon Company now mine a graphitic schist 15 feet thick, carrying from 8 to 15 per cent. of graphite, practically an inexhaustible supply."

And as to "Ore-dressing":—

"The process used by The Dixon Company at Ticonderoga owes its success to careful supervision. It is a wet process in which the ordinary practice is reversed, the "tails" being the useful product, while the "heads" are thrown away. All attempts at dry concentration have failed."

The production in 1882 was, as already stated, 425,000 lb., of which the output of the Ticonderoga mine was 400,000 lb., all others giving only 25,000 lb., better than which they were not expected to do in 1883, while The Joseph Dixon Company had laid themselves out to produce 500,000 lb.; altogether 525,000 lb., valued at 8 cents per lb. Let us say 18 cents of our rupee currency, and we get the high value (founded on cost as well as quality ?) of Rs. 20 per cwt., or Rs. 400 per ton. The local production, however, was certainly not much to place against 16,000,000 of pounds imported from Ceylon in 1882, with considerable quantities in the two following years.

The following as to kinds of graphite and their characters is interesting:—

"*Kinds.*—On account of the peculiar advertising it has had, graphite is commercially known as German black lead, Ceylon plumbago, and American graphite. German black lead is a product of Bavaria. It is of the amorphous variety, and is dressed chiefly by washing. Its price depends on its percentage of graphite and the nature of its impurities, varying from $1 to

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veins, and also in New Jersey and Pennsylvania. These are metamorphosed sand-stones with foliated graphite very evenly disseminated throughout in small flakes. The graphite found in beds is amorphous, and occurs principally in the south. It is in a sedimentary formation, is quite impure, and on account of its fineness cannot be successfully purified. Geologically, graphite occurs from the coal measures back to the oldest rocks. (See article by Professor Frazer, Transactions American Institute of Mining Engineers, Vol. IX., page 732; also Prof. J. S. Newberry's pamphlet on "The Origin and Relations of the Carbon Mineral," Annual Report, New York Academy of Sciences, Vol. II., No. 9, 1882.)

$10 per hundredweight in cargo lots. It is used in the manufacture of pencils, stove polish, and foundry facings. Ceylon plumbago is mined at Travancore, Ceylon, and is shipped from Colombo to all parts of the world. It occurs in immense veins of great purity: cobbing and sizing are the only preliminary operations it undergoes. It appears in the market graded according to size, as large lump, small lump, chip, and dust. Its price varies from $2 for dust to $10 per hundredweight for prime lump in cargo lots. It is used for all the purposes of the trade, except the manufacture of pencil leads. American graphite, from the nature of its occurrence, appears in the market only in the dressed condition. Its price ranges from $2 to $10 per hundredweight wholesale, according to purity and fineness. Fineness exercises considerable influence on the price of graphite on account of the difficulty of pulverizing it. American graphite is used for all purposes of the trade, and excels all kinds as a lubricant. It is the same geologically, &c., as the Canadian. Before the development of the American and Canadian mines the Ceylon mineral was the standard."

I cannot help the contradictory accounts as to the relative fitness of German and Ceylon plumbago for pencils, but must simply adhere to my belief that the finer Ceylon ore *is* largely used for pencils. Mr. Walker evidently writes under the impression that Travancore is that portion of Ceylon in which the plumbago is found which is exported from Colombo, the fact being, I believe, that not a pound of Travancore graphite is exported. The latest Travancore Administration Report, indeed, does not even mention plumbago as a product of the country. "Cobbing" seems to mean beating with a flat board, but has probably the extended meaning of breaking with hammers, &c. The preliminary operations are, except in the case of pure lumps, much more complicated than is indicated in the extract, involving hammering, cutting, picking, sifting, washing, &c., one of the tools employed in the Colombo yards being a combined hammer and axe. It will be seen that while Ceylon and American graphite are valued equally at $2 to $10 per cwt. (Rs. 4·33 to nearly Rs. 22) the German mineral has a minimum so low as $1, a price which could scarcely pay freight and charges. Comparative analyses of the Ceylon and Canadian varieties of graphite are given, which,

as of permanent value, will be found as a note to this paper.*

The figures are said, truly, to prove the often-repeated claim of the dealers in Canadian and American graphite that it is equal to the best Ceylon. The claim, pre-supposing that the samples were fairly chosen, must be fully conceded, for while the highest percentage of carbon in the Ceylon specimens analyzed is 99·792 per cent., the best Canadian is actually up to 99·815. The Ceylon mineral seems to have had a few fractions more of volatile matter. Both are almost absolutely pure, and did the Canadian and United States mineral occur in such a form in the enclosing rocks that it could be cheaply mined and prepared, there would of course be an end of the export of Ceylon plumbago to America. But if, in America, plumbago, however pure, is only distributed in the proportion of 8 to 15 per cent. mineral to 92 to 85 rock, those connected with the Ceylon enterprise need not, it would seem, concern themselves greatly with the competition in America of indigenous ore with that from our island. In view of analyses which give results so near 100 per cent. of carbon, we may well be amazed at the fact that the specific article on "Plumbago" in the new edition of the *Encyclopædia Britannica* should characterize graphite

* Analyses of Canadian and Ceylon Graphites.

Locality.	Specific Gravity.	Volatile Matter.	Carbon.	Ash.
		per cent.	per cent.	per cent.
Canada, Buckingham; vein graphite; variety, foliated	2.2689	0.178	99.675	0.147
Canada, Buckingham; vein graphite; variety, columnar	2.2679	0.594	97.626	1.780
Canada, Grenville; vein graphite; variety, foliated	2.2714	0.109	99.815	0.070
Canada, Grenville; vein graphite; variety, columnar	2.2659	0.108	99.757	0.135
Ceylon; vein graphite; variety, columnar	2.2671	0.158	99.792	0.050
Ceylon; vein graphite; variety, foliated	2.2664	0.108	99.679	0.213
Ceylon; vein graphite; variety, columnar	2,2546	0.900	98.817	0.283
Ceylon; vein graphite; variety, foliated	2.2484	0.301	99.284	0.415

as an "impure carbon." It is, on the contrary, the purest form of carbon in nature, with the one exception of the diamond, as indeed is explicitly asserted in other portions of the *Encyclopædia.*

Under the heading "Manufactures" there is interesting summarized information, which I quote :—

Proportionate Amounts of Graphite used for different purposes.

Manufactures.	Kinds of Graphite used.	Per cent.
Crucible and refractory articles, as stoppers and nozzles, crucibles, etc.	Ceylon, American ...	35
Stove polish	Ceylon, American, German ...	32
Lubricating graphite	American, Ceylon...	10
Foundry facings, etc.	Ceylon, American, German ...	8
Graphite greases	American ...	6
Pencil leads	American and German ...	3
Graphite packing	Ceylon, American...	3
Polishing shot and powder ...	Ceylon, American...	2
Paint	American ...	$\frac{1}{2}$
Electrotyping...	American, Ceylon...	$\frac{1}{4}$
Miscellaneous :—piano action, photographers', gilders' and hatters' use, electrical supplies, etc. ...	—	$\frac{1}{4}$
		100

A table like this will give many of the readers of this paper a new view of the multifarious uses of the mineral carbon called plumbago. It will be observed that, next to the manufacture of crucible articles, the great use of the mineral is for polishing and preserving from rust the ranges of stoves and other cooking appliances, which contribute so much to the neatness, cleanliness, health, and comfort of modern abodes. The proportion used for this purpose in Europe—in Britain at least—cannot certainly be below that given for the United States. There are graphite greases as contradistinguished from lubricants, and the mineral seems to be used for the packing of engines. From the largest forges where tons of steel are manufactured in Pittsburg, down to the studio of the photographer and the shops of the gilder and hatter, plumbago is of valuable use. And not only is it

called into requisition to produce the highest order of steel guns and steel armour for war-ships, but it is good for polishing the sportsman's powder and shot. Gunpowder used for blasting operations is also greatly improved by receiving a glaze or varnish of graphite, the philosophy of the operation being that thus the grains are prevented from absorbing the moisture which exists in mines and quarries.

Graphite enables the electrotyper to prepare and present to the world, cheaply and at will, casts of coins, woodcuts, copperplate maps, &c., equal in the most minute and intricate detail to the most highly prized and costly originals. But next to the boon which the real discovery of anthracite or natural coke in Ceylon would be, is the certainty, of which we are assured, that in our teeming supplies of plumbago the tea planters of Ceylon can get a paint for their stores, equal in its fire-resisting properties to asbestos paint. If this should prove to be correct, and we see no reason to doubt the statement, the prospect is that Ceylon will be speedily exporting, instead of importing, fireproof paint. Mr. Walker may well say in conclusion :—

"The growth of the graphite industry has kept pace with the age, each new development in metallurgy and engineering offering some new field of usefulness for graphite. For instance, it furnishes the pots for the manufacture of cast steel, and the nozzles and stoppers used in the Bessemer process. It is used in the manufacture of electrical supplies, &c. Fifty years ago graphite was little known and mis-named. Now it is of constantly increasing importance. From an insignificant beginning in the present century the industry has grown to its present proportions."

A list is then given of twenty-five American firms engaged in the plumbago industry, of which The Joseph Dixon Company of Jersey City, New Jersey, takes the lead, employing 500 hands in the manufacture of everything for which graphite is used. The same number of hands finds employment from the Eagle Pencil Company; while A. W. Faber, probably an immigrant or descendant of an immigrant from Nuremburg, employs 150 persons in his pencil factory. Others employ lesser numbers, six firms giving crucibles as their exclusive manufacture; three, lead pencils; four, foundry facings and lubricants; seven, stove polish and lubricants. It will thus be seen that except in the

branch of pencil-making, and perhaps electrotyping, the New World has gone, or is rapidly going, in advance of the old in the plumbago industry, which means corresponding advance in the steel industry. It is surely a striking incident in the romance of commerce that this ancient eastern isle of "Serendib," the scene of the mythical adventures of Sinbad the Sailor, should be the main source of supply of an article so useful in the industries and elegancies of life, the appliances of peace and war, and the pursuits of the artist and literary man, not only to countries in the Eastern hemisphere, but to the regions of the Far Western world.

Having noticed the leading establishments in Europe and America, where our Asiatic ore is so largely utilized, let us now turn to one of the compounds, or yards, with its brick and tar "barbecue" or platform, and surrounding sheds, in which Sinhalese men, women, and boys prepare, assort, and pack the mineral when received in Colombo from pits, none of which are nearer than thirty miles, and some of which are so distant as the District of Hambantota at the eastern extremity of the Southern Province. The chief exhibitor of plumbago at the Melbourne Exhibition of 1880-81 was Mr. W. A. Fernando, of No. 1, Brownrigg-street, Cinnamon Gardens, Colombo, and a description of his establishment, which the editors of the *Ceylon Observer* gave in their paper of August 12th, 1880, is, in all substantial details, correct in August, 1885. Mr. Fernando's exhibits at Melbourne were illustrated by a set of photographs, which, having been presented by the writer to Mr. Charles Moore, of the Sydney Botanic Gardens, unfortunately perished in the fire which destroyed the Exhibition building at Sydney. The photographs were thus described :—

"Photographs Nos. 1 and 3 (counting from the left-hand corner) show an enormous block of plumbago weighing originally 4 cwt. (one-fifth of a ton), and the dimensions of which, when photographed, were as follows :—2 feet in height, 2⅓ feet in breadth, 6 feet in circumference horizontally, 4 feet 10 inches vertically.

"The block, with other large and small specimens of the mineral, is placed on the platform (barbecue, or asphalted floor) on which pieces of plumbago (after being washed in water, so as

to remove earth and other foreign substances) are spread out to dry. In the background is seen the cadjan (cocoanut leaf) covered shed, in which Sinhalese (and a few Tamil) male and female labourers are employed, breaking up pieces of plumbago, removing hard pieces and bits of rock, and assorting. In this process small axes are used, which will be seen in the hands of coolies represented in the group No. 2.

"No. 4 shows one of the native bullock carts in which plumbago is conveyed to and from the stores, and No. 5 represents the casks into which—according to the classes into which it is carefully separated—the mineral is packed for export.

"No. 6 represents the owner of the establishment and his trusted overseers.

"Mr. Fernando's Plumbago Exhibits include :—

One case large lump plumbago.		
One barrel ordinary lump		do.
Do.	chips	do.
Do.	dust	do.

"Mr. Fernando also exhibits a Ceylon elephant, cut out of plumbago, and polished."

I have no doubt that photographic or other illustrations of the now important plumbago industry of Ceylon will accompany specimens of the mineral or objects, such as figures of elephants and other animals carved out of its substance, to the forthcoming Great Exhibition of the products and manufactures of the Colonies of Britain and her Indian Empire. Elephants and other figures are usually sculptured from blocks of the softest, and therefore the most valuable form of plumbago, and in proportion to the softness of the material, the sculptured objects are specially liable to breakage. I would suggest that blocks be chosen for sculpture purposes, of the variety of plumbago which in commerce is ranked second class, not because it is not pure in quality, but because in mechanical condition it vies in hardness with the rocky quartz for which the mineral has such a striking affinity. The account of Mr. Fernando's establishment to which I have alluded is as follows :—

"A visit we paid the other morning to the plumbago store of Mr. W. A. Fernando at No. 1, Brownrigg-street, Cinnamon Gardens, has given us a new and enlarged view of the ramifications of the Plumbago Industry of Ceylon. We were, of course, familiar with the rise and progress of our export trade in this the

only mineral of any importance of which Ceylon can boast. * * * But although it was quite evident that the digging and mining which brought so large a quantity of plumbago to light, as well as the carting, preparation, and picking, must give employment to a great number of people, we had no idea before the inspection of Mr. Fernando's store of the very considerable influence which the industry now has on the welfare of many thousands of the population in the Western, the North-Western, and Southern Provinces. The favourite mining districts are at present in the neighbourhood of Kurunẹgala, Avisáwélla, Ratnapura, and Kalutara, and in the Pasdun Kóralé. Mr. Fernando, a most intelligent enterprising Christian Siṇhalese of Moraṭuwa, whose father and family have for many years been connected with 'plumbago,' was unable to tell us that the seekers after plumbago were guided by any better indication than the appearance of the surface soil, or of pieces of the mineral cropping up through fissures in the rock. Here is just the case where a Government Geologist might afford valuable aid in developing an important industry. Mr. A. C. Dixon, if employed by Government during the Academy vacations, might be able to point with much confidence to undeveloped Crown lands likely to prove of great value for their beds of plumbago, and his advice to private proprietors might also save much time and money in trial pits, surface digging, and general exploration. Plumbago mines have been sunk in Ceylon several hundred feet in depth, and some are worked with all the appliances of an English mine, but, as a rule, the plumbago is found near the surface. It is difficult to say how many men are engaged in digging plumbago, but taking half-a-ton for each man per month in a favourable field as a high average, and making allowance for the wet seasons, holidays, &c., we may feel sure that no less than from 4,000 to 5,000 men were required to provide the quantity shipped last year. The carting to Colombo must have given employment to a good many others, perhaps more or less to 500 carters, carts, and pairs of bullocks. But it is the elaborate preparation now observed in the Colombo stores which has taken us by surprise. Plumbago is now picked and sized, we may say, as carefully as coffee. The various processes are seen to perfection at Mr. W. A. Fernando's store. He gives employment to from 120 to 150 men and women,* paying

* Siṇhalese women have only lately been induced to work as plumbago pickers; their manual dexterity gives them an advantage over men, but Mr. Fernando had trouble in overcoming a strange prejudice they had to plumbago, as poison or worse for them to touch with their fingers! Now they like the work and come to it readily.

from 50 to 75 cents per diem to the former, and 25 to 30 cents to the women. His stores and picking houses are all cadjan-roofed (that is, roofed with cocoanut leaves), for the very good, but to us novel and strange, reason that the tiles would inevitably fall off any roof under which plumbago was stored or prepared. The dust blown about makes everything so polished and slippery, even the roof rafters and reepers, that tiles constantly slip off and therefore the only safety lies in cadjans! The first process, is to wash the plumbago in large baskets, the smaller pieces and dust being afterwards spread on an asphalte barbecue to dry. By this means the quality is easily discovered by the practised eyes of the pickers, who separate (in much the same way as coffee) pieces affected by iron ore, pyrites, quartz, or other foreign material, a small piece of which passing into a consignment to the Battersea Crucible Works might ruin the whole lot. Some of the pickers are furnished with iron hammers to break up suspicious-looking pieces of the plumbago, and others again are employed in brushing the dust off good lumps, and polishing the same with cocoanut husks. There are punched sheet-iron sizers with holes of different dimensions (Nos. 1 to 4), and accordingly large lump, small pieces, chips, and dust plumbago are now-a-days carefully separated. It takes about 100 expert men and women to prepare two or three tons in a day; consequently this branch of trade must give employment to several thousands of people for the greater part of the year. The cask-making and packing afford further occupation, each barrel holding about 5 cwt., so that some 35,000 casks all made of *hora* staves (generally deemed a useless timber) were required for last year's shipments. The plumbago is also carried from the mines to Colombo in barrels, which, however, are sent back in shooks and so used repeatedly. Three men are supposed to make 8 or 10 barrels a day. Altogether, therefore, it will be seen that the Ceylon plumbago industry is a very important one to our Sinhalese neighbours.

"Mr. W. A. Fernando, whose model store is well worthy of inspection, sells to the European mercantile houses as much as from 1,200 to 1,800 tons per annum. In olden days he used to ship on his own account, and he has received prices as high as £32 and £48 per ton for lump plumbago, which is now only worth £15. His Brownrigg-street store should be visited during the present busy season by all who wish to get some idea of the importance of the Plumbago Industry of Ceylon."

We now feel confident that the number to which the

pursuit gives employment was much under-estimated in 1880, and that, considering that 5,000 persons were said to be engaged in mining in one year in a single district of the North-Western Province, our higher estimate of an average of 20,000 men, women, and children at present engaged in the various operations of mining, carrying, preparing, packing, and shipping Ceylon plumbago, is not beyond the truth.

It is curious that the Siṇhalese women should entertain a prejudice against plumbago as poison, seeing that it is included in the native pharmacopœia. We should have expected members of what Artemus Ward called "the female sect" to have been more troubled about the soiling of their persons and clothes by contact with the mineral, but in truth a coating of the shining ore, while easily got rid of by the use of water, produces no such hideous effect as that so familiar to us now in Colombo of the truly uncanny-looking coaling coolies, when proceeding to their houses after loading or unloading the bunkers of one of the multitude of magnificent steamers which now resort to our harbour. A polish of person, if not of deportment and manners, is the result of working amongst even the dust of plumbago, and it is curious to see the dark-skinned coolies of the plumbago stores walking about with their bodies shining as if they were electrotype statues vivified.

In its further metamorphic progress from vegetable to mineral, the form of carbon we call plumbago has certainly taken a great step in advance of the carbon we call coal, in getting rid of smoke entirely, and also of dirt. Coal, however, cannot be accused, as plumbago justly is, with causing a whole roof-covering of tiles suddenly to fall off, from the slipperiness created by wind-blown particles of the greasy mineral. We were greatly amused by Mr. Fernando's statement at the time, but others, Europeans included, who have to do with the preparation of plumbago, have fully confirmed his representation as to the incompatibility of plumbago dust and tiled roofs. In this connection we would advise visitors to plumbago compounds to be careful how they bear themselves in such slippery places. A sudden step on to the polished platform may end in an undignified tumble. And this reminds me of the sensation produced many years ago in Mincing Lane by the peculiar appearance of some

Ceylon coffee which had been dried on a barbecue where plumbago had been previously spread. An attempt to impart a factitious colouring to the beans was suspected until the requisite explanation was afforded.

As this paper may be read beyond the limits of Ceylon, it may be as well to explain that *cadjan* is a word, curiously enough of Malay origin, applied in Ceylon to plaited branches of cocoanut palms, used for roofing houses, sheds, carts, &c. *Compound* is a yard or enclosure, and *barbecue* is a platform.

I have already shown, what I may be allowed to repeat, that for the average shipments of 12,000 tons per annum of plumbago from Ceylon for the past five seasons, the yearly supply of casks must have been 45,000, and that the manufacture of these alone must have given welcome and remunerative employment to carpenters out of work by reason of the partial collapse of the staple colonial industry: this apart from the large numbers of persons (estimated above at 20,000) engaged in mining, carting, preparing, packing, and shipping the mineral.

Let us, therefore, hope that the plumbago industry of Ceylon may continue to prosper and extend, not as the result of wars or rumours of wars, but because of the steady and beneficial progress of the peaceful industries and arts which contribute to the elevation of humanity in all that constitutes comfort, happiness, and means to cultivate the loftier instincts and destinies of our race.

Appendix No. 1.

Letter from Mr. W. P. Ranesinghe.

In the Sinhalese work called "Yóga Ratnákara" ('the ocean of the gem-like prescriptions') I find the mode of purifying plumbago for medicinal purposes given at chapter XLIV. In the same chapter is found a mode of reducing mica or talc to ashes for the like purpose. The process of purifying is thus stated:—"Break the plumbago into small pieces, put it into a pot, pour over it the milk-like exudation of the *daluk* tree *(Euphorbia*

[*For continuation see page* 242.]

Appendix No. 2.—*Statement showing the Quantity and Value of Plumbago exported from Ceylon for the Fifty-one Years from* 1834 *to* 1884, *with the Revenue derived from the Mineral in the shape of Royalty, Customs Duty, License Fees, &c.*

[NOTE.—Pounds in the years anterior to the introduction of the Rupee currency have been converted into Rupees at the rate of Rs. 10 to £1.]

Year.	Quantity exported.			Value.		Customs Duty.		Royalty.		License Fees, &c.		Total Revenue.		Remarks.
	Cwt.	qr.	lb.	Rs.	cts.	Rs.	cts.	Rs.	cts.	Rs.	cts.	Rs.	cts.	
1834 ...	2,582	2	14	12,054	0	Free		—		—		—		
1835 ...	4,952	3	0	11,082	50	"		—		—		—		
1836 ...	12,644	0	5	14,663	50	"		—		—		—		
1837 ...	3,700	0	0	4,293	0	107	33	—		—		107	33	
1838 ...	1,164	1	12	1,379	0	34	44	—		—		34	44	
1839 ...	423	1	18	490	0	12	25	—		—		12	25	
1840 ...	981	0	0	1,225	0	30	66	—		—		30	66	Customs Duty at 2½ per cent. *ad valorem*.
1841 ...	2,002	2	7	2,684	50	67	62	—		—		67	62	
1842 ...	7,285	0	3	12,317	0	308	0	—		—		308	0	
1843 ...	3,677	3	20	5,238	50	131	0	—		—		131	0	
1844 ...	9,914	3	21	12,946	0	323	66	—		—		323	66	
1845 ...	19,245	0	15	24,519	50	613	0	—		—		613	0	
1846 ...	25,036	3	7	30,361	0	759	0	—		—		759	0	
1847 ...	9,248	3	11	10,583	50	Free		—		—		—		
1848 ...	6,787	0	0	7,062	0	"		—		—		—		
1849 ...	3,329	2	20	3,302	0	"		—		—		—		
1850 ...	23,021	1	6	38,330	0	"		53	0	—		53	0	
1851 ...	23,865	1	2	52,554	0	"		229	0	—		229	0	Free by Ordinance No. 9 of 1847.
1852 ...	13,110	1	21	26,281	0	"		406	0	—		406	0	
1853 ...	19,577	2	25	40,572	0	"		533	0	—		533	0	
1854 ...	17,451	2	19	39,162	0	"		103	0	—		103	0	
1855 ...	6,129	3	16	11,448	50	"		11	0	—		11	0	
1856 ...	13,380	2	27	33,380	0	"		438	0	—		438	0	
1857 ...	33,497	0	4	83,850	0	"		894	0	—		894	0	

1858 ...	19,432	3	12	33,841	50	971	0	219	0	—		1,190	0	Customs Duty at $2\frac{1}{2}$ per cent. *ad valorem.*
1859 ...	17,510	3	11	41,138	0	1,029	0	374	0	—		1,403	0	
1860 ...	75,660	0	23	239,535	50	5,990	50	3,190	0	—		9,180	50	
1861 ...	38,345	1	23	110,643	50	2,767	0	3,836	0	—		6,603	0	
1862 ...	40,895	3	13	130,789	50	3,271	0	5,843	0	—		9,114	0	
1863 ...	65,128	0	3	281,246	0	7,032	0	15,549	0	—		22,581	0	
1864 ...	84,028	2	4	404,314	50	10,109	50	11,999	0	—		22,108	50	
1865 ...	40,143	3	5	151,206	0	3,775	83	2,289	0	—		6,064	83	
1866 ...	56,278	3	14	218,605	50	5,473	87	4,200	0	—		9,673	87	
1867 ...	45,836	0	14	193,601	0	4,842	0	3,187	0	—		8,029	0	
1868 ...	141,095	0	14	720,410	50	18,013	0	13,026	0	—		31,039	0	
1869 ...	226,131	3	8	889,620	0	22,240	50	16,118	0	—		38,358	50	
1870 ...	85,248	3	18	345,622	0	Free		6,796	0	—		6,796	0	
1871 ...	125,257	1	5	620,953	50	”		9,948	0	—		9,948	0	
1872 ...	136,051	2	23	438,366	64	”		15,659	0	—		15,659	0	
1873 ...	173,996	0	17	1,479,395	44	”		* 45,660	0	—		45,660	0	
1874 ...	149,938	1	3	1,440,166	87	† 47,209	94	—		7,513	0	54,722	94	Licenses to dig for plumbago, Rs. 10 each, with 10 per cent. of value of plumbago dug in the case of the Western Province.
1875 ...	110,023	1	0	1,100,232	53	55,011	79	—		7,169	0	62,180	79	
1876 ...	117,361	1	2	1,173,612	64	58,680	55	—		695	0	59,375	55	
1877 ...	96,792	1	21	967,924	37	‡ 48,396	32	—		140	0	48,536	32	
1878 ...	84,634	3	15	846,348	84	21,546	81	—		211	0	21,757	81	
1879 ...	162,495	2	24	1,624,957	15	40,624	15	—		1,786	0	42,410	15	
1880 ...	205,738	2	9	2,057,385	81	51,434	94	—		1,130	0	52,564	94	
1881 ...	259,909	0	16	2,599,091	42	65,028	4	—		1,642	0	66,670	4	
1882 ...	260,166	1	6	2,601,663	3	65,042	3	—		2,585	0	67,627	3	
1883 ...	262,773	3	1	2,627,737	58	65,693	94	—		4,727	0	70,420	94	
1884 ...	182,425	3	10	1,824,258	40	45,606	82	—		1,054	0	46,660	82	
	3,526,211	0	27	25,742,446	22							841,389	49	

* The value of some confiscated mineral included. † Royalty of Rs. 10 per ton, from 1st April.

‡ Royalty of Rs. 5 per ton, or 25 cents per cwt., from 21st December.

antiquorum) and boil it three days in a low fire such as is used for boiling rice ; take it out and wash it. It is now purified." It is, I understand, used by the Sin̥halese medical men as a tonic. Sin̥halese medical science is derived from the ancient Aryan works of Northern India, and latterly to some extent from Southern India. I have not with me any very old medical work of the Sin̥halese.

I am very much puzzled about the date of the book I refer to.

At the commencement of the work the author says it was begun in the month of Wesak (May to June) in the sixteenth year of King Buwanéka Báhu. Now there were, it appears, seven kings who bore that name.

The last king of that name flourished in A.D. 1557, and reigned according to Turnour only eight years. I do not find his name mentioned in the Sin̥halese translation of the Mahawan̥sa. The sixth of that name ascended the throne in A.D. 1464, and reigned only eight years. These two kings not having reigned sixteen or more years each, the work could not be attributed to their times. The fifth of that name, beginning from A.D. 1378, appears to have reigned twenty years. The fourth reigned only fourteen years. The time the second and third reigned is not stated. The first reigned only eleven years.

So that the book must have been composed either in the reigns of the second, third, or the fifth kings of that name. Taking the latest as the safest, it must have been composed in the reign of Buwanéka Báhu V., who reigned from 1378 to 1398 A.D. The tradition, according to the editor's preface, is that the king in whose time the work was composed reigned at Jayawardana Pura, or Kóṭṭé. Mr. Turnour says that Buwanéka Báhu the 5th reigned at (Gangásiripura) Gampola. This is a mistake ; for the Mahawansa (chap. 91) distinctly says that Buwanéka Báhu V. built Jayawardana Pura, south of Kelani Pura.

If the tradition is correct, there could be no doubt that the work was commenced in the reign of this king, because I find that the second and third kings of that name reigned at Kurunẹ́gala, and not at Kóṭṭé.

The sixteenth year of the reign of Buwanéka Báhu V. would be A.D. 1394, and the work I referred to must have been commenced 491 years ago.

The word මිනිරන් [*miniran*] is also used for talc or mica, but the book in one place qualifies it by saying කළුමිනිරන් [*kalu miniran*], 'the black *miniran*,' which is no doubt the plumbago of commerce.

Appendix No. 3.

Revenue derived from Royalty on Plumbago dug on Crown Lands, including Payments for Licenses to dig for Plumbago, from 1850 *(when Royalty was first levied) to* 1884.

	Western Province. Rs.	Southern Province. Rs.	Total. Rs.
1850	53	—	53
1851	229	—	229
1852	406	—	406
1853	533	—	533
1854	103	—	103
1855	11	—	11
1856	399	39	438
1857	859	35	894
1858	219	—	219
1859	341	33	374
1860	3,045	145	3,190
1861	3,464	372	3,836
1862	4,722	1,121	5,843
1863	12,725	2,824	15,549
1864	10,768	1,231	11,999
1865	2,025	264	2,289
1866	3,682	518	4,200
1867	2,839	348	3,187
1868	10,398	2,628	13,026
1869	14,493	1,625	16,118
1870	6,001	795	6,796
1871	9,086	862	9,948
1872	14,537	1,122	15,659
1873	40,371	5,289	45,660
1874*	5,588	1,925	7,513
1875	6,939	230	7,169
1876	475	220	695
1877	—	140	140

* From April of this year the royalty was collected at the Customs at the rate of Rs. 10 per ton—a rate which was reduced to Rs. 5 in December, 1877. Of the royalty collected at the Customs from April, 1874, this table takes no account, but only of sums collected at the Kachchéries. For the revenue under every form see the comprehensive and detailed return constituting Appendix No. 2. The great disparity between the figures for the Western and Southern Provinces, from 1881 onwards, seems to be due to the fact that, while in the Western Province 10 per cent. of the plumbago mined is taken as "rent" in

	Western Province. Rs.	Southern Province. Rs.	Total. Rs.
1878 ...	81 ...	130 ...	211
1879 ...	986 ...	800 ...	1,786
1880 ...	— ...	1,130 ...	1,130
1881 ...	1,172 ...	470 ...	1,642
1882 ...	1,995 ...	590 ...	2,585
1883 ...	3,987 ...	740 ...	4,727
1884 ...	954 ...	100 ...	1,054

It would appear that the royalty collected at the Galle Custom-house in the past five years has been :—1880, Rs. 5,962 ; 1881, Rs. 3,972 ; 1882, Rs. 3,228 ; 1883, Rs. 4,798 ; and 1884, Rs. 3,764. The licenses issued in the Southern Province seem to have been :—1880, 113; 1881, 47; 1882, 59 ; 1883, 74 ; and 1884 only 10,—the latter a significant sign of the depression of the industry.

A return of licenses issued in the Western Province for the four years ending 1884 enables us to appreciate the preponderance of the Kalutara district as a plumbago-yielding territory over the other districts of the Province. The licenses taken out in this district for each of the past four years were, respectively, 35, 94, 102, and 25. Colombo shows 10, 13, 5, and 1 ; Negombo 2, 23, 10, and 2 ; Ratnapura 7, 7, 5, and 1 ; Kégalla shows very poorly, proving that the vast bulk of the mineral which came on the railway at Polgahawela was from the Kurunégala District. In 1881 none were reported as issued in the Kégalla Disrrtct ; 1882 and 1883 gave only 2 each, and 1884 only one. For the whole Province the figures were :—

	Licenses.
1881 ...	54
1882 ...	139
1883 ...	124
1884 ...	30

All the figures within our reach seem to show that in the past

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addition to proceeds of licenses to dig at Rs. 10 each, no rent is collected in the Southern Province, but simply the Rs. 10 license fees.

N.B.—That some small sum ought to be added to plumbago revenue, which is at present credited to stamps ; for Mr. Saunders, Government Agent, Western Province, states that "the license fee of Rs. 10 is collected and brought to account in different ways at the different Kachchéries. In some cases cash is taken and credited to Land Revenue under the head 'Licenses to dig Plumbago ;' in other cases a stamp of Rs. 10 is fixed to the bond, and then of course the revenue gains that amount under the head 'Stamps.'"

five years of large export, the Kurunẹgala district of the North-Western Province and the Kalutara district of the Western have supplied probably three-fourths of the whole plumbago recorded in the Customs returns.

Appendix No. 4.

Sessional Paper XIX. of 1873.

Return of the Number of Plumbago Pits.

	Crown Land, on license.	Private Land.	Land specially exempted.
Western Province ...	762 ...	280*a* ...	38
North-Western Province ...	— ...	18*b*, 54*c* ...	10
Southern Province ...	419*d* ...	187*e* ...	11*f*
	1,181	539	59

(*a*) The claims to exemption of royalty of many of these lands are under consideration.

(*b*) Land purchased from Government and subject to the payment of royalty.

(*c*) Private lands so far as is known.

(*d*) 108 mines now in operation.
311 mines abandoned for the reason of their contents having been exhausted, or not worth the expense of incurring.

(*e*) 51 mines now in operation.
136 mines abandoned for the reason of their contents having been exhausted, or not worth the expense of incurring.

(*f*) 8 mines in operation.
3 mines abandoned for the reason of their contents having been exhausted, or not worth the expense of incurring.

Statement showing the Quantity of Plumbago exported during the last twenty years, during periods of five years; and the Amount of Royalty received during each of such periods.

Years.	Quantity exported. Cwt.	Amount of Royalty received. Rs.
1853 to 1857 ...	87,011 ...	2,080
1858 to 1862 ...	191,845 ...	13,464
1863 to 1867 ...	291,415 ...	37,227
1868 to 1872 ...	713,785 ...	61,611
	Cwt. 1,284,056	Rs. 114,382

Statement showing the Quantity of Plumbago exported and the Amount of Royalty received from 1868 *to* 1872.

Years.		Quantity exported. Cwt.		Amount of Royalty received. Rs.
1868	...	141,095	...	13,026
1869	...	226,132	...	16,119
1870	...	85,249	...	6,796
1871	...	125,257	...	9,949
1872	...	136,052	...	15,721
		Cwt. 713,785		Rs. 61,611

Appendix No. 5.

An Ordinance to provide for the collection of the sums due to the Crown on Plumbago.

No. 21 OF 1873.

Preamble.

WHEREAS a certain sum in lieu of rent is now levied on all plumbago dug on Crown lands, and a royalty is due to the Crown on all plumbago dug on private lands, and the payment on these dues is largely evaded, and it is expedient to secure the same by collecting them as a royalty at the different ports of shipment: It is enacted by the Governor of Ceylon, with the advice and consent of the Legislative Council thereof, as follows:—

Dues on plumbago.

1. There shall be raised, levied, and paid, as a royalty upon all plumbago of the produce of this Island exported beyond seas a duty of 50 cents per cwt.*

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* The royalty of Rs. 10 per ton, or 50 cents per cwt., was levied from 1st April, 1874, but by the Ordinance No. 22 of 1877 the royalty on all plumbago exported was fixed at 25 cents per cwt., instead of 50 cents, from 21st December 1877.

Appendix No. 6.

Report on the following Petition for permission to dig for Plumbago on Crown Lands, referred by the Government Agent of the Western Province to the Mudaliyár of Héwágam Kóralé.

To whom addressed :—The Hon. the Government Agent, Western Province.

Name of Petitioner :—Merenge Don Sadris Senerat Appuhami, of Liyanwala.

Purport of Petition :—Praying for permission to dig for plumbago in an acre of Crown land called Wellendalanda, situated at Liyanwala in the Mẹda Pattu of Héwágam Kóralé.

Date of Petition :—2nd June, 1885.

Report No. 464.

Name of Land :—Wellindalanda.

Boundaries :—North by land purchased by Abraham Appuhami and Don Carolis Appuhami; south by a goraka tree and a kahaṭa tree; east by goraka tree and ant-hill; west by a date tree and kahaṭa tree.

Description of timber trees onthe land :—No valuable trees.

How far from nearest forest? No forest.

Whether petitioner is a lessee of any other land or not? No.

His character and means? Bears a good character; he has no landed property in this district, but he says that he has in the Rayigam Kóralé.

Whether there is an abandoned pit on the land, and, if so, abandoned by whom? No.

Reference to any former reports made touching this land :—None.

(A printed application is enclosed for the survey of the land.)

J. M. E. Pieris.

Ranalé, 8th June, 1885.

Appendix No. 7.

Form of Lease of Plumbago Land.

THIS Indenture, made at Colombo on the 6th day of July in the year of Our Lord One thousand Eight hundred and Eighty-five, between the Hon. F. R. Saunders, Government Agent for the Western Province, acting for and on behalf of Her Majesty Queen Victoria, of the one part, and M. Don Sadris Senerat Appuhami, of Liyanwala, his heirs, executors, administrators, and assigns, of the other part.

Whereas the said M. Don Sadris Senerat Appuhami, of Liyanwala, has contracted and agreed with the said Hon. F. R. Saunders, as such Government Agent as aforesaid, and acting as aforesaid for and on behalf of Her Majesty, for a Lease of the Mines hereafter described, and intended to be hereby demised for the term of one year from the date of these presents, at the yearly rent hereinafter specified, and payable as hereinafter is mentioned, and under and subject to the covenants and agreements hereinafter expressed and declared :

Now this Indenture witnesseth, that in consideration of the yearly rent hereinafter reserved, and the covenants and agreements hereinafter contained, on the part of the said M. Don Sadris Senerat Appuhami, of Liyanwala, his heirs, executors, administrators, and assigns, to be respectively paid, observed, and performed, he, the said Hon. F. R. Saunders, as such Government Agent as aforesaid, and acting for and on behalf of her Majesty as aforesaid, hath granted, demised, and leased, and by these presents doth grant, demise, and lease, unto the said M. Don Sadris Senerat Appuhami, of Liyanwala, his heirs, executors, administrators, and assigns, all and all manner of Mines, Beds, and Veins of Plumbago, and the Ore thereof, which have been or shall hereafter be discovered or opened under, within, or about all such lands and premises as belong to Her said Majesty, within the boundaries following, to wit :—

One acre of Crown Land called Wellindalanda, situated at Liyanwala in Mẹda Pattu of Héwágam Kóralé: on the north by land purchased by Abraham Appuhami and Don Cornalis Appuhami; on the south by a goraka tree and kahaṭa tree; on the east by a goraka tree and ant-hill; on the west by a date tree and kahaṭa; —with full and free liberty, power, and authority, to and for the said M. Don Sadris Senerat Appuhami, of Liyanwala, his heirs, executors, administrators, and assigns, and their agents, servants, and workmen, with or without horses, waggons, carts, or other carriages, from time to time, and at all times hereafter, to enter into and upon the said lands and premises, or any of them or any part thereof, or to dig and sink such and so many pits and shafts as shall be proper for getting all such Plumbago or the Ore thereof, and to stack or deposit the said Plumbago or the Ore thereof, when raised, on the lands contiguous to such pits or shafts, until the same can be conveniently removed ; and to erect any engine or engines for working or getting such Plumbago or the Ore thereof ; and to make all necessary ditches and drains ; and to use for foot-people, horses, waggons, and other carriages,

all necessary and convenient roads for carrying of the said Plumbago or the Ore thereof; and all other privileges which shall be necessary, requisite, and appertaining for or to the finding, discovering, raising or working, procuring or carrying away, the said Plumbago or the Ore thereof; and all the right, title, interest, property, claim, and demand whatsoever of Her said Majesty in, to, out of, or upon the said Mines, Beds, and Veins, hereby demised as aforesaid; and for the said M. Don Sadris Senerat Appuhami, of Liyanwala, his heirs, executors, administrators, and assigns, to cut, take, and appropriate all such indigenous timber growing on the said lands, as may be necessary for any purpose connected with the opening and working of the said Mines, or preserving or removing the Ore or Plumbago which may be obtained therefrom, upon payment to the said Hon. F. R. Saunders, Government Agent, or his said successors, of so much money as he or they shall or may demand for the said timber.

To have and to hold the said Mines, Beds, Veins, and all and singular other the premises hereby demised or intended so to be, and every part thereof, with their and every of their appurtenances unto the said M. Don Sadris Senerat Appuhami, of Liyanwala, and his heirs, executors, administrators, and assigns, for and during the term of one year, to be computed from the day of the date of these presents, and from thenceforth ensuing, and fully to be complete and ended, yielding and paying in advance for the said term the sum of Ten Rupees and further one-tenth part of all Plumbago dug, or its value, unto the said Hon. F. R. Saunders, or his said successors in the said office of Government Agent for the Western Province.

And the said M. Don Sadris Senerat Appuhami, of Liyanwala, doth hereby covenant that he and his heirs, executors, administrators, and assigns, shall and will, within three months from the date hereof, open and work one or more Mines within the lands aforesaid; and in default of doing so the lease shall be forfeited.

And the said M. Don Sadris Senerat Appuhami, of Liyanwala, further agrees that he will not remove any of the Plumbago so dug from the depôt where it is stored until it has been inspected and measured by the proper officer appointed by the Government Agent, and the correct value of the share due to Government has been correctly ascertained, and that he will at all times, upon being required, allow the said Hon. F. R. Saunders or his said successors, or his agent or servants, at all times to enter upon the

lands hereinbefore mentioned, and to reside thereon, and to inspect the Mines, Beds, or Veins that shall have been opened thereon, and to take an account of the produce thereof; and, if need be, to secure and remove all other metals or minerals, not being Plumbago, which shall be found in the said lands.

AND it is further agreed by and between the said parties hereto, that in case the said M. Don Sadris Senerat Appuhami, of Liyanwala, his heirs, executors, administrators, or assigns, shall assign over or otherwise part with this Indenture, or the Mines, Beds, or Veins, or the rights or privileges hereby demised, or any part thereof, to any person whatsoever, without the consent of the said Hon. F. R. Saunders, Government Agent, or his successors, being first had and obtained in writing for such purpose, or if the said M. Don Sadris Senerat Appuhami, of Liyanwala, his heirs, executors, administrators, or assigns, or if they, their servants, or agents, shall in any manner act contrary to these presents or to the provisions of the Ordinance to provide for the collection of the sums due to the Crown on Plumbago, No. 21 of 1873; then, and in either of the said cases, it shall and may be lawful to and for the said Hon. F. R. Saunders, or his successors, for and on behalf of Her said Majesty or Her successors, into the Mines, Beds, Veins, hereby demised, and the said lands, or any part thereof in the name of the whole, wholly to re-enter, and the same to have again, retain, re-possess, and enjoy, and to confiscate all Plumbago excavated from the said lands by the said M. Don Sadris Senerat Appuhami, of Liyanwala, anything herein contained to the contrary notwithstanding.

IN WITNESS WHEREOF the said parties hereto have set their hands and seals, the day and year first above written.

The stamp is here affixed.

Witnesses:
CHARLES FLANDERKA.
J. H. WITTEBRON.

F. R. SAUNDERS,
Government Agent.

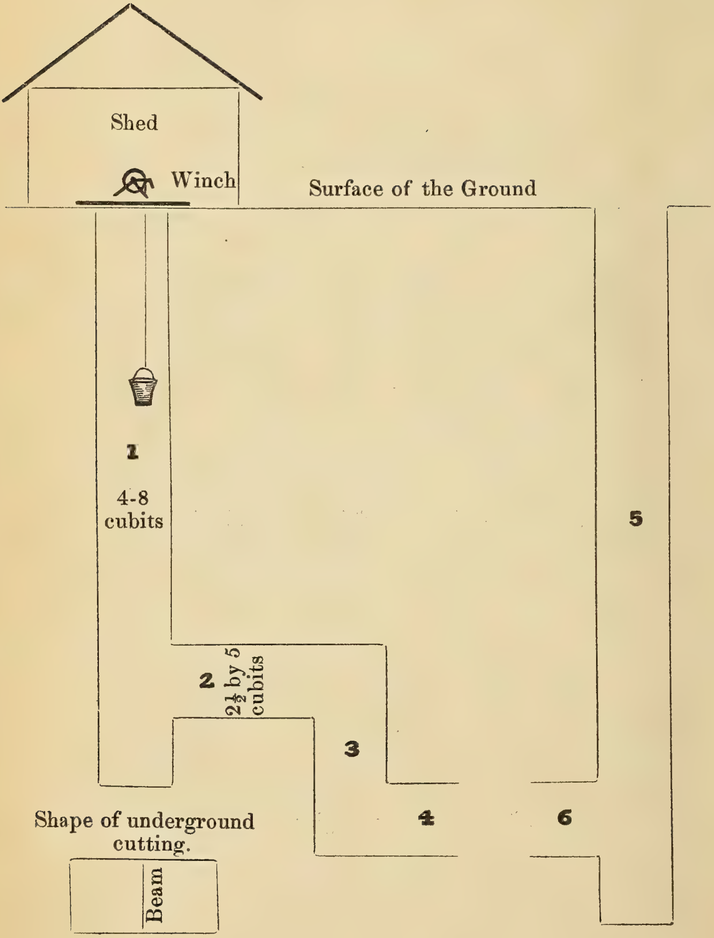
The license holder will be allowed the option of redeeming the Crown share at the assessed value. If he declines, the Government share will be sold by public auction.

Witness:
CHARLES FLANDERKA.

H. L. CRAWFORD,
for Government Agent.

PLUMBAGO MINING.

Plan of an Underground Cutting.



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Appendix No. 8.

Description of a Plumbago Mine, and the System of Excavation pursued in the Southern Province.

[Translation from the Siṇhalese, supplied by W. E. T. Sharpe, Esq., Govt. Agent.]

PLUMBAGO is excavated in two ways :—

(i)—Sinking large pits [*miniraṇ patala kẹpíma*]; and

(ii)—Cutting underground [*dóná kẹpíma*].

From large pits the ore is taken without much difficulty. An underground cutting is shown in the accompanying plan. The pit between the two straight lines shown by the figure marked is first dug. The breadth of it is from 4 to 8 cubits. The pits are not square, but oblong. If the underground cutting is to be dug straight, it cannot be dug deeper than 70 or 80 yards [210 to 240 feet, but Mr. Jacob De Mel's is 450 feet] owing to the difficulty of breathing for want of sufficient air deeper on. A lamp is kept in it.

Figure 2 shows the extension of an underground cutting ; this is generally $2\frac{1}{2}$ by 5 cubits. In some places they are large enough to allow a miner to walk erect, and they are generally 16 yards underground, and are cut to a length of 24 yards; at a depth of 60 yards, they are cut to a length of 8 yards. No. 4 is a deeper cutting, but as it cannot be extended at such a depth, a new shaft (No. 5) has to be sunk, and access to it availed of by No. 6. This pit is called the air pit, because it is purposely opened to admit of air. If any more diggings towards other directions in the pits marked 1 and 5 are required, it can be done in the same manner. The water, earth, and plumbago in these pits [*dóná*] are taken up through the first opened pit. If necessary, they could be taken on land [to the surface] from the air pit also. For the purpose of taking out earth, &c., there is a winch fastened on the surface. By tying a rope to the body of the winch, by hanging one or two tubs to the rope, and by winding the winch, the water, earth, and plumbago in the pit are taken out. A shed is put covering the pit for protection against sun and rain. After lining the inside with planks on the underground cutting to prevent land slips, very strong beams are fastened close to each other. As the digging progresses the planks are placed and beams fastened. Three or four workmen are necessary to descend to these underground cuttings. It is with small crowbars that the pits are dug. In the course of the digging, if rocks are found, they are blasted. The miners descend at 6 o'clock in the morning and

come up at the same hour next morning. They take their meals inside the pit. In some places, when they descend the pit at 6 in the morning, they ascend at 6 in the evening. When one batch comes out another goes in. The underground cuttings must be lighted both day and night. There must be on the top (on land) about five men to work the winch and to receive the earth, &c. By means of an air pump the pit can be penetrated further than the distance mentioned above.

Appendix No. 9.

The Precariousness and Difficulties of the Plumbago Mining Enterprize.

[The Galle "Gravets Mudaliyár" having reported that although plumbago is found in various villages of the Akmimana Division, mining for the mineral is not remunerative, the following remarks were made, apparently by the Atapattu Mudaliyár.]

"I BEG leave to state that there are signs of plumbago being in the land within the four gravets, besides in the villages enumerated by the Mudaliyár, but the difficulty is to get to the regular vein. While there appears to be plumbago on the surface of the land, when a little deeper is dug there is nothing to be found; when sinking the pit somewhat deeper still, there appears again, and it is very deceptive.

"It is unsafe for a person to try on his own account the mining of plumbago, unless by chance the proper vein can be found. While in search of the vein the pit is sunk; within a few yards of the pit there may be the proper vein unknown to the persons employed. It is an expensive and unsafe speculation, as the baling out of water, which requires to be done both day and night, is very costly. Some pits have to be sunk between 30 and 50 feet deep. At Nidowa in Ratgama there is to be found good plumbago, but after much expense, if by some cause or other while there is much plumbago to be had, a day or two should fail to bale out the water, the whole pit is apt to be covered with the surrounding earth, and no one would attempt to renew the search in that pit. Thus the loss to the speculator is great, even if he should afterwards succeed in getting some."

Appendix No. 10.

Graphite, Mica, and Asbestos, and the absence of Fossils from the Metamorphic Rocks of Ceylon

are thus discussed by Dr. William King, of the Geological Survey of India, in reply to queries preferred by me when asked to write a Paper on Graphite :—

"Our knowledge of the organic origin of graphite is as yet little better than speculation............I fancy graphite expresses a greater amount of metamorphism than anthracite............We have one of the finest specimens, almost, in the world of museums in our museum at Calcutta, which my brother Ælian sent up. ....It is difficult to tell you why there are no fossils in your metamorphic rocks : there may have been very little life at the time of their formation and that of the lowest forms, and these may have been obliterated by metamorphism, or so altered that nothing but the result of their chemical decomposition now remains—*e. g.*, this graphite. I do not think age would have anything to do with the obliteration of vegetable structure, if it ever existed ; metamorphism (which includes a tremendous lot of forces, chemical and otherwise) is quite sufficient............I do not think there is any relation between graphite, mica, and asbestos—except in this way, that mica, being the common mineral in mica schist, and mica schist being an altered form of veinic shales, it is reasonable to suppose that seams of vegetable matter might have been associated with those shales. For instance, it is conceivable that shales with vegetable matter in layers will, by pressure and in time, become carbonaceous shales and coal : while intense metamorphism might bring about a further change into mica schist and graphite—graphite which exists in granite venis ; and mica in that case is the constituent of the granite, the graphite being an accidental mineral. Asbestos is a form of the magnesian rocks, so common in some gneiss regions ; it has nothing to do with the graphite.

"Very possibly the forms of vegetable life were more minute than those of coal : but they may have existed in immense numbers."

Dr. King's opinion is of course decisive as to the absence of mineral affinity between the two substances which of all others best resist fire, and which common quality led me to put the question. But associated with our gneiss rocks are beds of that very magnesian limestone of which asbestos is stated by Dr. King to be a form. As regards mica, the Sinhalese describe graphite as its black form, "*Kalu-miniran*," and one can scarcely wonder, for

not only is graphite lustrous like mica, but specimens occasionally occur which can be separated into plates, like lamellar mica, while very dark brown mica, when found associated with plumbago, simulates to some extent the lamellar forms of the latter mineral.

Appendix No. 11.

Minerals associated with Plumbago.

KNOWING that Mr. A. Murray, of the Public Works Department, had received a geological training, I referred some specimens of plumbago, quartz, and iron pyrites for his opinion, with the results shown in the following correspondence :—

Mr. Ferguson to Mr. Murray.

"I hope you won't think me troublesome, but in my paper on plumbago I wish to make no mistakes. Mr. Williams has kindly sent me some specimens from a mine on the road from the North-Western Province to Dambulla, mainly to show how plumbago is associated with quartz. The very best mineral and in largest quantities thus occur. Kindly look at No. 2 in the box sent herewith, and say if I am correct in describing it as crystalline quartz. Mr. Williams wrote of pieces of the quartz looking like Derbyshire spar, and I am sorry he did not send me a specimen separate from the plumbago, but this specimen will enable you to judge if the quartz is normal or any variety worth indicating.

"No. 1 includes a number of beautiful auriferous-looking bits of iron pyrites, which came in the box from Mr. Williams. You will notice that the golden iridescence shades off occasionally to faint green. Mr. Dixon attributed the green tint to the presence of copper, when reporting on a specimen sent by Mudaliyár Jayetilleke in 1880, when the gold fever was on. Do you agree with Dixon ? Or have we nothing beyond very beautiful iron pyrites ? I enclose a bit of white quartz ending in gold and green pyrites in this letter, which I think of getting set as a brooch. Of course the plumbago people do not delight in iron in any shape, and I am sorry I have not, to send you, a piece of compact heavy ironstone, the nucleus of plumbago which Mr. W. A. Fernando told me was unsaleable. I suppose that, apart from particles of iron being in the mineral, the quality of the plumbago was adversely affected by contact with the iron ? In any case, those interested in plumbago love the appearance of veins of white quartz, while, with good reason, they hate iron.

"And talking of iron, look at that magnificent specimen of iron pyrites(?), No. 3, so like a mass of polished silver, which was found in Mr. Jacob De Mel's mine just as you see it. De Mel tells me it has not been touched up in any way. In returning it kindly say what you think of it—whether you think that by any possibility the beautiful polish of its plates is due to the contiguity of graphite? I fancy you will say "no." Is the mass a conglomeration of iron pyrites, or what? De Mel said the weight was 14 lb.

"The amount of negative evidence I have obtained as to the existence of anthracite in association with plumbago, or in any form or place in Ceylon, seems to me overwhelming. But I should like to have your opinion before closing up. Do you think it possible that Gygax could have mistaken any black ore of manganese or iron, or any other substance, for anthracite? Certainly, no human being has seen any of the mineral since he announced its existence."

Mr. Murray's reply.

"I have looked over the fine geological specimens you have sent for inspection.

"No 2 I should describe as semi-opaque *quartz rock.*

"*Quartz*, properly speaking, is pure silica, of which rock crystal is the purest and most transparent.

"The specimens in No. 1 packet are very pretty samples of iron pyrites. The green tints are due to the presence of sulphate of copper, but in very small quantity.

"I should much like to see a specimen of the compact heavy ironstone (metamorphosed, I conclude) you refer to as being associated with plumbago. Ceylon miners have probably the same reason for objecting to its presence as colliers at home have to the presence of trap rock in the coal measures, since in the vicinity of such rock coal has lost its bright lustre and regular face, as well as muchof its bituminous or inflammable character, more nearly resembling anthracite than coal, and yet different from both in that it has concretions of iron pyrites or other minerals.

"No. 3 specimen—iron pyrites—is simply splendid.

"It is one solid crystal of that metal, and by no means a conglomeration of pyrites: the polished surface is quite natural, and not due to the contiguity of plumbago.

"Plumbago is held to be a metamorphosed form of anthracite, and probably Gygax classed the impure forms of this mineral

under that head. I have never seen anything approaching to real anthracite in the Island.

"I return the samples. The specimen of pyrites (iron), quartz r ock, and plumbago is exceedingly interesting."

Mr. Murray wrote again with reference to some other specimens I sent for his inspection :—

"The minerals you got at De Mel's are all iron pyrites closely associated with plumbago. The ferruginous appearances of some of the specimens I am inclined to attribute to oxidation through the agency of water or damp finding its way along natural fissures.

"The specimen of plumbago is perfect, and exhibits an exceedingly fine form of crystallization.

"Still more interesting is the specimen of garnetiferous quartz associated with plumbago. The dark dullish mineral in the quartz matrix is, I believe, an amorphous form of plumbago in a state of transition, for, on breaking a piece off your specimen for the purpose of testing it, I found secretions in a semi-carbonised state which were easily pulverised.

"The crystal (octahedron) of iron pyrites is certainly exquisite, and one of the forms by which it is recognized.

"Among other forms of crystallization the *cube* is common. I enclose some crystals of it, which please return after inspection. They were taken out of the gneiss quarry at Fishers' Hill, Mutwal."

Rocks associated with Plumbago.

Having received from Mr. Williams, Acting Government Agent of Kurunẹgala, a very fine mass of quartz crystal found in a plumbago mine, and which bore traces of having been embedded in kaolin, I obtained Mr. Murray's opinion of the specimen, thus :—

"The specimen of translucent rock crystal is exceedingly fine. The crystal is the typical form—rhombohedral—a six-sided prism terminating in a six-sided pyramid ; the white earthy substance is kaolin.

"Crystals in process of formation assume plane, smooth surfaces : the polished facets are not due to the influence or action of other closely-associated minerals, but are merely the definite shapes or forms assumed in obedience to the laws of crystallization. Geologically, quartz belongs to the metamorphic or hypogenic system, and contains one equivalent of silica to two of oxygen."

On other specimens of pyrites, mica, quartz, &c., found associated with plumbago, Mr. Murray reported thus :—

"*Specimen No.* 1.—A garnetiferous nodule of quartz, apparently found imbedded in plumbago. I have broken the specimen in two to show this clearly.

"*Specimen No.* 2.—Brown mica, which is mainly composed of silica, potash, and magnesia.

"*Specimen No.* 3.—One of the best and purest forms of plumbago I have seen.

"*Specimen No.* 4.—Mica schist (quartz and mica), closely associated with plumbago, iron pyrites, &c. The piece I have broken off exhibits two shades of yellow, due doubtless to presence of sulphur in varying proportions.

"*Specimen No.* 5.—A fine specimen of a highly garnetiferous vein of quartz passing through plumbago.

"*Specimen No.* 6.—Iron pyrites, plumbago, and quartz, with a thin shell of ironstone—the first of the kind I have seen.

"*Specimen No.* 7.—A band of steatite or soupstone traversing plumbago. The crystallized rock in the smaller specimen is quartz.

"*Specimen No.* 8.—Of the three varieties, the light dull-looking stone seems to me an impure amorphous form of plumbago, impregnated with iron and mixed with felspar and silica.

"The last two specimens are brown mica schist associated with plumbago andiron pyrites."

Appendix No. 12.

Local Use of Plumbago.

As this paper was undergoing final revision, the following interesting communi cation reached me from Mr. W. P. Ranesinghe, who, in consequence of inquiries made at my request, has ascertained that native potters do use plumbago as a glaze. He gives also information as to the local manufacture of crucibles, and a curious tradition as to the last King of Kandy being a dealer in plumbago :—

"I just got from a man the mode of glazing pots in this country.

"The pots are made and kept in the shade to dry, and when half dry they are trimmed and smoothed with a stick, and are again smoothed with a chank. Then plumbago is pulverized and rubbed over the pots, and again smoothed with the chank and dried in the shade. If the plumbago does not stick to the pot, a little lime-juice is sprinkled over the pot, and the plumbago is

rubbed over it and dried. When quite dry, the pots are exposed to the sun and then fired.

"Crucibles are now made with a mixture of pulverized plumbago. To three parts of potter's clay one part of plumbago and one part of burnt chaff are added, and the whole ground well. The crucible made of this material will last four months, whilst the ordinary crucible will last only a month.

"I understand that the last King of Kandy sold plumbago to merchant vessels. There is, I am told, a field at Kẹgalla where it is said that Molligoda Adigar dug plumbago. This will be interesting if true."

Appendix No. 13.

Plumbago and Pencil-making in Germany.

The following is the reply of Mr. Walter Freüdenberg to questions of ours respecting the use of plumbago in Germany :—

"In reply to your letter of 13th I beg to say that Ceylon plumbago is not used for pencil manufacture in Nuremberg—Siberian graphite is taken instead.

"The 'needle' plumbago you refer to is not to be had in very large quantities, and I cannot give you accurate information about its final destination—i. e., whether it is used for crucibles or lubricating purposes.

"In Germany, a great many Steel Works do not use any plumbago at all, but Krupp takes large quantities every year. As far as I can judge at present—I have no accurate knowledge of the statistics—the consumption of Ceylon plumbago in Germany is not on the increase.

"I send you a catalogue of Johann Faber, Nuremberg, which kindly return after perusal. It will give you an idea of the importance of the pencil industry in Nuremberg, and one or two items in the preface may be of interest to you."

The large "Illustrated Catalogue of Johann Faber, of Nuremberg and London," alluded to above, is a very fine specimen of lithography, and gives certainly a vivid idea of the extent and importance of the pencil-making industry, the coloured illustrations showing many hundreds of varieties of pencils of every possible shade, from deep black to red and azure blue, with combinations of pencils, pens, erasers, and all the appliances required by the artist, literary man, accountant, artizan, ball-goer, &c. The preface states :—

"The first black lead pencils were manufactured in England,

from the celebrated Cumberland graphite, more than three centuries ago.

"At the end of the last century Conté of Paris invented an entirely new system in the manufacture of lead pencils, and artificially produced them in various degrees from inland graphite mixed with clay, ascribing to them the term "Polygrades" derived from the Greek words "ζραφειν" (to write) and "πολυς" (many), signifying a writing material possessing many degrees.

"Conté being the original inventor of the above system, all other statements are incorrect.

"In the year 1761 the ancestor of Johann Faber established a factory under the title of A. W. Faber, and in 1840 Johann Faber and his brother Lothar (the present proprietor of the firm of A. W. Faber) succeeded their father at Stein in the management of the business. From that period dates the success and popularity which the firm of A. W. Faber has enjoyed. Whilst Johann Faber devoted himself exclusively to the manufacturing department, Lothar Faber occupied himself with opening business connections throughout the civilized world. It may therefore be stated, without any pretence to ostentation, that the reputation which the A. W. Faber pencils have acquired is due to the indefatigable energy and labour of Johann Faber, and to his experience as a pencil manufacturer during a period of upwards of 37 years.

"In 1876 Johann Faber withdrew from the business of his father, and in 1880 established under his own name, "Johann Faber," a new establishment for the manufacture of black and coloured lead pencils, &c.

"It need scarcely be mentioned that the goods now produced by Johann Faber are of the same excellent quality as those which he previously manufactured for the old firm, and his newly-invented system of grinding the graphite and clay, called "System Graphite Broyé," has enabled him to produce the most perfect and uniform quality of lead which the modern pencil industry can furnish to-day.

"The present production and sales of Johann Faber's pencils are now (after only four years' existence) about 3,000 gross per week, and he employs 200 hands. These figures will speak for themselves."

This firm is, of course, but one of many engaged in turning out 250 millions of pencils per annum in Albert Durer's ancient city.

The following details as to quality of black lead pencils are given :—

"*Designation of the Degrees.*—The below-mentioned marks

are those generally adopted by artists and others to all lead pencils in order to distinguish their grades or depth of shade :—

BBBBBB	extra soft and extremely black	for a full rich deep shade.
BBBB	very soft and extra black	
BBB	very soft and very black ...	for very deep shading.
BB	very soft and black ...	for deep black shading.
B	black ...	for ordinary shading.
HB	medium and black ...	for sketching.
F	firm ...	for ordinary drawing and office use.
H	Medium hard	for sketching and drawing.
HH	Hard	for firm lining and drawing and short-hand writing.
HHH	Very hard	for firm sharp lines and sharp drawing.
HHHH, HHHHHH	Extra hard	for very sharp and very defined lines.

No. 1	2	3	4	5 "
Very soft and black.	Soft and black.	Hard.	Harder.	Very hard

The tendency of the following paragraph is to show that Johann Faber, at least, does not use Siberian plumbago, and the fair inference from what is stated would seem to be that "Graphite Broyé" pencils are made wholly of finely-ground black lead, although I suspect no pencils are now manufactured without some mixture of clay :—

"*Johann Faber's Finest and best Lead Pencils, Graphite Broyé.*"—These lead pencils are made from the very finest graphite procurable. The graphite, after undergoing a series of washing and grinding by the most delicate and improved system in existence, thus rendering it perfectly pure, is very highly compressed.

My Graphite Broyé pencils stand unexcelled as the finest drawing material in existence, combining all the qualities which art can demand:

1st. Their points are firm and keep well.

2nd. The lead consists of one piece throughout.

3rd. They are absolutely pure and free from any particle of grit or foreign substance.

4th. The degree is maintained throughout, whether hard or soft.

5th. The most renowned artists throughout Europe all testify to the superiority of these "Graphite Broyé" pencils over the so-called "Siberian" or "Spanish Graphites."

6th. The harder degrees are extremely even in temper, and are better adapted for photographer's use than anything that has yet been introduced."

Appendix No. 14.

The Local Average Prices of Plumbago, and the History of The Joseph Dixon Company

are thus noticed in a communication from a merchant who had read proofs of this paper :—

"You refer to the average valuation and Customs valuation as Rs. 200 a ton for qualities and periods. The average by the figures you have given would be Rs. 146, but even that I should say was high. If dust and chips are included, I question if you should put it higher than Rs. 100. Good lump is now worth say Rs. 120; chips, Rs. 75; and dust, Rs. 45 or thereabouts.

"You refer frequently to The Joseph Dixon Crucible Company. This Company has had a good many vicissitudes. Dixon, I think, was originally a partner with Dr. Gautier in the firm of J. H. Gautier & Company, of Jersey City, who sent Mr. Whiteford here about 1873; and I understood from Whiteford that Dixon and Gautier disagreed and split. Then I think Dixon died, and the Company was formed, and, if I am not mistaken, dissolved and re-formed."

Appendix No. 15.

The Renting and Selling outright of Plumbago Lands

are thus discussed in a note from the Government Agent of the Western Province, the Hon. F. R. Saunders :—

"I still adhere to my view that it is better for Government to sell than to rent plumbago land. What we do is to cut the land up into small lots of a little above one acre, and this induces competition and prevents any monopoly being created.

"I send you a list showing the prices realized for a block of plumbago land in the Rayigam Kóralé, sold in 1880. It would be many a year before we should get Rs. 8,150 as *rent* from a land of 1 acre, 1 rood and 13 perches. (See lot 556).

"These lands are situated at Pelpiṭigoḍa in the Rayigam Kóralé, and were the subject of a law-suit, which we won in appeal to the Privy Council, after losing our case in the Supreme Court here.

"The value of Rs. 200 a ton put on plumbago by the Customs is very misleading. I presume it is done to show the great value of exports from this Island.

"If a man pays Government the sum of Rs. 5,000 an acre for plumbago land, and yet has to pay Customs duty of Rs. 5 a ton, I don't think the man who is renting an acre of land need complain of paying an extra Rs. 5 a ton, instead of Rs. 5,000 down."

MEMO.—*Pelapitiyagoḍa Plumbago Lands in Rayigam Kóralé, Kalutara District, sold at Colombo Kachchẹri in June*, 1880.

	Lot.	Extent. A.	R.	P.	Sold for Rs.
1	552	1	1	11	240
2	553	1	2	30	480
3	554	1	1	30	185
4	555	1	2	36	300
5	559	1	1	27	130
6	561	1	1	20	185
7	562	1	3	24	70
8	563	0	3	8	31
9	564	1	3	24	200
10	567	1	0	17	1,000
11	570	0	3	38	150
12	571	1	0	6	540
13	572	1	2	23	6,200
14	573	1	3	16	2,900
15	574	1	3	38	1,000
16	575	1	2	18	2,050
17	576	1	0	24	4,000
18	577	1	0	14	550
19	579	1	2	28	255
20	580	1	2	28	1,000
21	582	1	1	14	250
22	583	1	0	34	1,900
23	584	1	1	2	255
24	556	1	1	13	8,150
25	557	1	2	9	1,600
26	558	1	3	34	135
27	566	1	2	5	2,750
28	569	1	1	18	1,600
29	565	1	3	14	180
30	560	1	0	28	110
31	585	1	0	34	830
		45	0	25	39,226

Average price per lot, Rs. 1,265.
Do. per acre, Rs. 871·68.

There can be no doubt that the Customs valuation of Rs. 200 per ton for plumbago is, as Mr. Saunders states, too high, but as the royalty is at a fixed rate, the over-valuation does not affect exporters. As to the policy of leasing instead of selling lands, so as to prevent monopoly, here is what Governor Sir W. H. Gregory said in 1873 :—

"With regard to the other proposal to sell the land, the reason why we could not agree to that has been pointed out by an hon. gentleman (the Government Agent, Central Province), who speaks with some authority on this subject. I think that would be the wrong course to pursue. We have tried it in one or two instances; we have had paddy rents sold to the cultivator. The sums thus realized benefited the Colony for a time, but it was a short-sighted and unjust policy against posterity to alienate a source of income for all time in order to obtain food for the present. It is precisely so in this case. We can't tell to what proportion this trade may grow : capital will no doubt be attracted to it, machinery be employed once the trammels and restrictions are removed; and therefore to sell the plumbago land at once would be unwise as regards the future of the Colony. Then, as regards the natives themselves. What has fallen from my hon. and learned friend (Mr. Ferdinands) is intimately borne out by all parties in the country. He says that the natives who understand the case are entirely in favour of this measure, and extremely anxious that this Bill should pass. There are those who would like the land put up for sale; but they are the capitalists—the small digger infinitely prefers taking out a license and working a pit himself ; in the one case he realizes for himself the profit of the venture, whereas if all the promising lots fall into the hands of rich people, he merely becomes a workman at wages for them. Undoubtedly the sale of plumbago lands, irrespective of the objections I urged before, would be eminently distasteful to the bulk of the people, though popular enough with the rich few."

Appendix No. 16.

The Dutch Name or Plumbago

being "*pot-loot*" ('pot-lead'), it would seem as if the Hollanders must have recognized what is now the principal use of the mineral, from their earliest acquaintance with it. I referred the philological question to Mr. Donald Ferguson, who replied as follows :—

"Yes ; *pot* in Dutch is the same as English. I find in the Dutch-French dictionary I have (published 1768), that *pot-loot*

is explained as "blue mountain-chalk with which one can write and draw," the French being given as "crayon bleu, crayon de *Hollande*," which looks as if the Dutch were the first to use it for pencils, &c. The word *pot-loot* was also used for pencil simply, as "Leen my uw *pot-loot*" ['Lend me your pencil'].

Appendix No. 17.

Plumbago in the Kolonná Kóralé.

Mr. Charles Shand states :—

"The plumbago found at the Vegiriya village, Kolonná Kóralé, below the Kolonná estates, is considered to be the finest flaky (micaceous) plumbago found in the Island, being peculiarly soft and dark in colour, and realizes the highest price in the London market. This deposit has only been largely worked within the last three or four years, and there are several promising spots in the neighbourhood, but the present low price and heavy transport interfere with development."

Specimens sent by Mr. Shand bear out his description of the fine quality of the mineral. It is, however, not micaceous, only mica-like in its laminated structure.

Appendix No. 18.

Return of Plumbago conveyed by Rail to Colombo.

Station from	1882.	1883.	1884.
	Tons.	Tons.	Tons.
Kalutara South	—	7	16
Veyangoḍa	346	223	—
Mirigama	322	258	18
Ambépussa	7	26	—
Polgahawela	4801	4664	3349
Rambukkana	32	78	74
Kandy	112	18	35
Kaṭugastoṭa	14	43	61
Wattégama	8	72	—
Mátalé	—	—	—
Náwalapiṭiya	—	15	10
Total ...	5642	5404	3563

The above table I owe to the courtesy of Mr. Pearce, who explained that no separate accounts of plumbago as an item of traffic were kept before 1882. The figures given show that the

contribution made by the mineral to railway traffic has been important, the quantity carried verging closely on half the total exports, and there can be little doubt that a very large proportion of the plumbago which came on the line at Polgahawela was from the rich mines of the North-Western Province, very little being from the Kęgalla District. It seems probable that all the plumbago mined in the Central Province came on the railway at the stations beteewn Mátalé and Náwalapiṭiya, the quantity being insignificant.

Appendix No. 19.

Export of Plumbago in 1885.

Just before printing, we have received the following figures :—

Export of Plumbago.

January–June, 1885	...	cwt.	92,386
In July ...	...	„	25,846
		Total—cwt.	118,232

Carried down by Railway.

1st January to 9th August, 1885	cwt.	47,026

Appendix No. 20.

A Faithful and Intelligent Sinhalese Kangani.

[From the "*Ceylon Observer,*" 31st August, 1885.]

"Our researches into the history and character of the plumbago enterprise brought us into pleasant intercourse with the two plumbago princes—fine specimens of shrewd, well-educated Christian Sinhalese gentlemen—Messrs. Jacob De Mel and W.A. Fernando. We ought to reverse the order of the names on the principle of *senior prior*, for Mr. Fernando claims to be "the father of all the plumbago merchants." We were amused at this assumption of paternity by so juvenile-looking an individual. Mr. Fernando is one of those men who seem as if they never would grow old, or at least never look old. His brilliant black eyes have all the lustre of youth, and he moves about with all the elasticity of a young man. We were, therefore, greatly surprised to hear him claim ten years more of age than has passed over his grave and rather aged-looking brother-in-law, Mr. De Mel. Mr. Fernando is enthusiastic in regard to all connected with the plumbago

enterprise; but to see how his eyes glisten when he speaks of his kangani,* the head man of the preparing works! He told us that all who came to his place acknowledged the superiority of his kangani, and certainly we were no exception. It was to Cornelius De Silva, known familiarly and in every day life as Harmanis Appu, we were ever referred, and always with the result that we obtained just the full and correct and substantially scientific details we desiderated, regarding the characteristics of the purest and best forms of plumbago, as contra-distinguished from the hard form known as *yabora*, or iron dross; and also regarding the rocks associated with plumbago, such as *tiruwánagala* (white stone, or quartz), *miniran̥* (mica), and *diya-rat-ran̥* (water-gem-gold, or iron pyrites.) Although kangani, and quite an intelligent-looking gentleman in his out-of-door dress, Harmanis Appu, in the preparing compound, dresses as scantily, works as hard, and is as effectually electrotyped and polished by the black shining mineral as any of the coolies he superintends. It was he who, with great pains and ingenuity, overcame the difficulties connected with one of the most slippery substances in nature, by sawing first-class lumps of plumbago, and securing them one above another with iron pins run through them, so as to form the pyramidal trophy, which was placed on a table in the hall of the Asiatic Society, to illustrate the Paper on Plumbago, and which still stands there with chips, dust, and the associated rocks. In order to reach the Museum in safety, the plumbago had to be wrapped round and secured with gunny cloth. Besides the large mass of plumbago to which Mr. Davidson alluded as in prospect for the Exhibition, we submit that a trophy of first-class lumps of our staple mineral in the form of a good-sized dágoba would be a very effective and very characteristic object in the Ceylon Court, as much so, perhaps, as a trophy of pearl shell. The lumps could be sawn smooth, so as to be easily superimposed, and the slipperiness could doubtless be overcome by the use of a dark-coloured cement."

[It may be added, that from long observation and experience the kangani is able, by a kind of instinct, to recognize lumps which come to the store, as fine soft plumbago; as plumbago, pure but hard, or as mineral formed over a matrix of quartz, or mica, or iron pyrites, without testing the specimens by their very different specific gravities: the purest plumbago being lightest in weight, as well as brightest in lustre.]

---

* Overseer.

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ROYAL ASIATIC SOCIETY,

CEYLON BRANCH.

PROFESSOR VIRCHOW'S ETHNOLOGICAL STUDIES ON THE SIṆHALESE RACE.

Read before the Anthropological Society of Berlin, January 17, 1885.

TRANSLATED BY W. R. KYNSEY (FELLOW KING AND QUEEN'S COLL. OF PHYSICIANS) AND J. D. MACDONALD, M.D.

(Read February 13, 1886.)

AT the time when I wrote my treatise concerning the Vẹddás of Ceylon, and their relations to the neighbouring races, it was not possible for me to obtain a single satisfactory scientific description of the principal race of the Island, viz., the Siṇhalese. What I was able to ascertain concerning them is stated on page 60 and the following pages.*

My disappointment was great at not seeing the large caravan which Herr Hagenbeck brought to Europe in 1883. At the sitting of the Paris Anthropological Society, of October 18, 1883 (Bulletins, page 713), M. Manouvrier made an official report concerning that company, the meagreness of which is even acknowledged by the author himself, who explains it as due to want of courtesy on the part of the leader.

Last year another caravan visited the country, and I consider myself fortunate in finding it still here on my return

* Of his former treatise on the Vẹddás.

to Berlin. Herr Hagenbeck himself had the kindness to give the necessary instructions, so as to facilitate my examination. After his departure Herr Von Schirp had the kindness to bring the people before me one by one. Notwithstanding this, I was only able to examine a small number of the forty persons of which the company consisted. There was all the preparation of their approaching departure going on, and I must say, like the Paris Commission, that the time spent in obtaining my results was too short. Besides, the determination of personal relations was surrounded with much difficulty. At first I was informed that with the exception of some dancers from Hindústán, the whole company was of Ceylon origin, and that of the latter, two, viz., Pichchai and Murugappa, were Tamils. Both, I was informed, belonged to a suburb of Colombo. Later, however, I ascertained through the interpreter (who said he himself was born of European parents in Ceylon) that the Tamils in question belonged to the neighbourhood of Bombay.

Herr H. Becker ("Cinghala and the Siṇhalese, the Land and the People of Ancient Paradise": Frankfurt-on-Maine, page 18), who wrote a not sufficiently trustworthy description of the same people, says that Murugappa came from Madras, and Pichchai from Negapatam, south of Madras. Whatever the truth may be, the hope to see Ceylonese Tamils face to face proved a delusion, and the zeal with which I engaged in the examination of this rarity influenced not a little my further proceedings.

Of the Siṇhalese proper, I chose two groups. As representing the first group, I chose the following :—

1. A little three-year old boy called Jimmy (Sinni), who with justice had become the favourite of the public ; stark-naked, with the exception of a silver fig-leaf, he tumbled unweariedly, and in constant good humour, about the arena.

2. His mother Lúsa (Louise?) Nóna, about twenty-five years old ; his father Girigóris, or Grigóris Appu, twenty-

nine years old; his mother's sister, Iṅga Nóna, sixteen years old; and his mother's brother, Andre Appu, twenty-one years old.

Herr Becker had made three families of these. A *Nóna* family, an *Appu* family, and an *Appuhámi* family. Nay, he went a step further, in taking Abuhámi for an Arab, or, as they say in Ceylon, for a Moor. I must leave it undetermined whether the man was called Appu or Abu. The name sounded to me almost like Appu, and Herr Kotelmann writes it so ("Magazine of Ethnology," 1884, page 165). There was no difference of opinion, however, concerning the family connections of the group.

For the second group I made choice of two of the tallest and strongest men. Both were Kúruwe (elephant-drivers) from Kandy, viz., Puñchi Baṇḍá, twenty-four years old, and Ukku Baṇḍá, twenty-two years old. Herr Becker has given a photograph of the latter. Becker is inclined to suppose a mixture of Malabar blood in these, on account of their size; but I would refer to my treatise (pages 60–64), where I have quoted the evidence of the best observers, Davy, Cordiner, and Sirr, according to which the Kandyans differ from the rest of the Siṅhalese by their greater strength, darker colour of skin, and better growth. Our Kúruwe may, therefore, be considered as the representatives of the highland type, as the members of the Abu Nóna family that of the lowland type.

In how far these represent the pure type must be left undetermined, in view of the differences of my former craniological examinations, and of the strongly prominent individual peculiarities appearing in the persons before me. The Paris Commission, whom the same difficulty faced, had come to the conclusion that the persons brought to Europe were taken from a very mixed portion of the population, and contained a large mixture of Malabar blood. I shall refer to this again, after I have discussed the principal peculiarities; but will here observe that I have come to no sure conviction

on the point. In my former works I had come to the conclusion from the reports before me, that "the Siṇhalese belonged to a dark, or more correctly, a brown, smooth-haired race, not prognathous or moderately so" (page 65); and this has been confirmed in the numerous persons by whom we were visited.

As far as the colour of the skin is concerned, the Paris Commission had found that the darker portions corresponded to No. 28 of the colour table; the lighter lay between No. 22 and No. 43.

According to the table of the Stenochromic Society, the colour at the bend of the elbow in one man was determined at the letter *g*, in the second transition stage from cinnabar to greenish orange, and that of the breast of a little girl at *i* orange.

I found in the family of Abu Nóna the following:—

1. The father Girigóris showed a dark brown colour: on the brow 28=Radde 3 *g;* on the cheek 21=Radde 4 *k;* on the breast 29=Radde 3 *g;* on the hand (back) 28–29=Radde 2 *e;* palm 30–31=Radde 4 *o* approximately.

2. The mother's brother Andre: brow Radde 3 *j;* cheeks Radde 4 *h–i;* breast Radde 3 *h;* back of the hand 28–29; the fingers Radde 30 *d;* putting the skin on the stretch Radde 3 *h*, palm 26. The deep colour of the breast was on the whole reddish, but still with a strong shade of yellow.

3. The mother Lúsa Nóna: brow 30–31=Radde 4 *i;* face 32–33; breast 29–30=Radde 3 *i–k;* back of hands 22–37=Radde 4 *h*–3 *h;* palms 24. In these are shades of unequal lightness.

4. The mother's sister Iṇga: very light, back of hands 29.

5. The little Jimmy (Sinni): breast 29–30; arm Radde 3 *f;* face lighter, more yellowish brown.

NOTE.—I may observe that according to Radde, 1 cinnabar signifies 2 cinnabar in the first, 3 in the second transition towards orange, 30 carmine in the transition towards cinnabar.

Of the Kúruwe, of Kandy :—

1. The older, Puñchi Baṇḍá : on the brow Radde 30 *i;* on the cheek Radde 30 *k;* on the arm 29=Radde 3 *f* and Radde 10; on the palm 30–31=Radde 3 *e*.

2. The younger, Ukku Baṇḍá : face 4 *k;* breast 28–29; arm (inside) 29–30=Radde 3 *i*, (outside) Radde 2 *e;* dorsum 28–29; palmar 31.

These are chiefly shades of colour which, according to Radde's scale, belong to orange (4), and to cinnabar in the second stage of transition to orange. Next follow some cases in which cinnabar in the first stage of transition to orange (2), or carmine in the second stage of transition to cinnabar (30), was determined.

There is some interest in comparing the two persons from India :—

1. Murugappa, thirty-two years old : brow 29=Radde 3 *g;* breast 27–28; dorsum of hand likewise=Radde 30 *b–c;* palmar surface 31–32=Radde 4 *g–h* and 3 *g–h*. The nails are light and short. The shades of colour belong to the mixture of cinnabar with orange, of carmine and of orange. On putting the skin on the stretch, an underground of a yellowish colour appears, with black specks and stripes. On a simple inspection, the impression of a reddish tone of colour is imparted.

2. P chchai, nineteen years old : face 21=Radde 4 *h;* breast 43=Radde 4 *f;* dorsum of hand 28=Radde 2 *f;* palm 26=Radde 4 *k*.

In these appear no other colour than that occurring in the Ceylonese, and here also orange (4) dominates. Still, there is not wanting the transition stage of cinnabar to orange (2 and 3) and from carmine to cinnabar (30). I cannot therefore say that I found in the colour of the skin any different shades of colour not found in the skin of the Ceylonese. If the former, for example, show a much darker shade of skin than the Kandy men, still it must not be overlooked that even the Ceylonese among themselves show different degrees of darkness and fairness in their skins.

Lúsa Nóna had much lighter shades of colour than her husband and her brother. For example, I noted for Girigóris 3 *g*, for Andre 3 *h*, for Lúsa Nóna 3 *i*, therefore at the time one degree lower (clearer), whereas Pichchai (4 *f*) showed a degree higher (darker) than Girigóris.

In Ceylon the opinion prevails that the Tamils are distinguished by a darker skin than the Siṇhalese. But when Davy asserts that the colour of the skin of the Siṇhalese varies from light brown to black, it must be clear that the difference cannot be constant. Percival expressly declares that the colour of Siṇhalese women approaches the yellow, and even Cordiner asserts that the colour of the higher classes is quite as light, or even lighter, than that of brunettes in England. One may perhaps infer from all this that the variation of colour of skin among the Siṇhalese is even greater than among the Tamils, and that a larger number of persons with a small amount of pigment in the skin occur among the Siṇhalese; but a means of distinguishing the dark Siṇhalese from the Tamils is not to be looked for in the skin colour alone.

I would like finally to remark that the assertion of Cordiner, that the palmar surfaces of the hands and feet of the Siṇhalese of all classes are uniformly white,—an assertion also found in Selkirk,—has not been quite corroborated in our Siṇhalese. The palms of the men show 30–31, of the women 26–24 of the Parisian colour table, therefore quite clear shades, yet still plainly pigmented. The man from Madras or Bombay, viz., Pichchai, had likewise No. 26. Yet it must not be forgotten that the Parisian colour table leaves lacunœ, and that the determination of Radde's tables give different values: for example, for No. 30–31, at one time R. 3. E., at another time R. 4. 0.

The colour of the hair was fixed by the Paris Commission, No. 48 of the table, *i. e.*, as pure black. In fact, the richly developed heads of hair of the men, woven long and gathered at the back or side of the head into a knot (*koṇdé*),

has an ebony tone of colour in all, only in the case of Ukku Baṇḍá it had a brownish appearance, was at the same time slightly curly, whilst it otherwise looked flattish, and at the most somewhat wavy towards the points. With Jimmy (Sinni) it was quite black. The careful attention paid to the hair in the way of washing, combing, and oiling, contributes not a little towards increasing the favourable impression made by it.

Hair was also richly developed on the upper portions of the body. This was especially true of the eyebrows and the eyelids, whilst the beard in the case of the men was not thick, and in several was somewhat curly.

On the other hand, the older men had hair richly developed on the body, a fact which the Paris Commission had also noted. It said: "The rest of the body was remarkably covered with hair, the breast and the hollow of the spine in particular presented, in the case of the oldest men, true tufts of hair somewhat curly and several centimetres long."

I give here shortly my notes of each person examined :—

1. Lúsa Nóna: Hair strong, black, quite smooth, only at the ends somewhat wavy, slung in a knot behind; eyebrows strong; eyelashes long and thick.

2. Iṉga Nóna: Hair quite black and smooth; only a few wavy "love locks" before the ears. The hair descends far on the brow, so that a large portion of it (brow) appears black through short hairs. There is a soupçon of a moustache on the upper lip.

3. Andre Appu: Hair quite black, 30 cm. long, and throughout slightly waved; eyebrows strong, quite black, and shining; eyelashes long and thick; beard on chin and lips more richly developed; hair somewhat wavy.

4. Girigóris Appu: Hair long and black, stretched back over the head and held by a comb, gathered up in a knot behind; moustache and beard on chin somewhat sparse and wavy.

5. Jimmy: Quite black, short cut, thick rough hair.

6. Ukku Baṇḍá: Hair long, black, with brownish shade, curly, gathered in a knot; eyebrows moderately developed; eyelashes short.

7. Puñchi Baṇḍá: Hair long and wavy, gathered in a knot behind; black beard, thin, but long and somewhat wavy; breast and arms strongly covered with hair.

I add here also the results of the examination of the two Indians:—

1. Murugappa: Hair smooth and black, cut short in front, slung in a knot behind; beard thin, but individual hairs strong; breast and abdomen covered with strong and long hair.

2. Pichchai: Hair quite black, drawn back tightly, scarcely wavy; eyebrows strong; eyelashes long; moustache black and strong; whiskers moderately strong.

On microscopic examination I find that in the hair of the Siŋhalese there is, without exception, almost a complete failure of, or an extremely diminished, medulla. On transverse section a very small central pith is occasionally observed, generally not greater in diameter than a blood corpuscle, and quite colourless; only sometimes, as, for example, in the case of the little Jimmy (Sinni), this narrow strip of medulla is pigmented. The peculiar colouring matter of the hair lies in the fibrous portion, and strongest in the surperficial parts. Only the outermost layer (cuticula) is quite colourless and homogeneous. The colour, which is due to particles of pigment arranged lengthwise in stripes, varies very considerably. In many of the hairs observed lengthwise the colouring particles appear quite black, and also on cross section the particles appear almost pure black, whilst in other cases the external particles appear of a brown colour, and the cross section of same show light brown, nay sometimes yellowish-brown particles. This is the case with Lúsa Nóna and her brother Andre Appu, although their hair, on microscopic examination, appeared a pure black. Even in Ukku Baṇḍá the microscopic colour is brownish.

I must also add here that Tamil hair, which I obtained through the good offices of Herr Freüdenberg, the German Consul, and from Dr. Kynsey, has the same characteristics. In four of the examples, one shows a light yellowish-brown, one a light greenish-brown, a third a dark brown, and only one a pure black pigment. In the case of one Malabar I found, besides black hair, also brown.

The form of the cross section in the case of the Siṇhalese is either quite round or slightly compressed on one side, so more or less kidney shaped. This is very distinct in Ukku Baṇḍá. The hair of the women is finer, but very dissimilar in thickness. On the whole, the hair of the Tamils appears to me, on comparison, darker, somewhat stronger; yet even in their case the thickness, as well as the shape of the cross section, varies in the same individuals in a similar manner as amongst the Siṇhalese. The Paris Commission determined the colour of the iris partly at No. 2 of the table, and partly between 5 and 3 *d h*, more or less dark brown. I can corroborate this, only that I also noticed nut-brown eyes, as did Davy before me. The iris of Lúsa Nóna corresponded to No. 3 of the table, whilst her brother Andre showed the dark brown colour of No. 2. Really black irises as noted by Sir Davy and Cordiner I have, like Herr Kotelmann, never seen. I consider that they never occur. Cordiner asserts that the white of the eye appears strikingly clear, and I can corroborate this in the case of children and women, yet the men had invariably yellowish-brown pigment in the conjunctiva, especially in the middle layer. In Andre and Puñchi Baṇḍá, I noticed light brown specks. The same occurred also in the Indians, of which Pichchai showed a moderately dark brown; Murugappa, on the contrary, a somewhat variegated iris, which externally showed a dark brown, internally a light brown zone, and between these zones a light yellow ring. Further, the eyes of the Siṇhalese appeared generally large and brilliant, somewhat elongated in the case of the men, more round in the women and children.

The interorbital distance was small, a fact also noted by the French Commission. The distance in the case of the women was 31 mm., in the men from 34 to 35 mm., whilst in the Indians it amounted to between 37 and 39 mm. The length from canthus to canthus measured in the women 30 mm., in the Appu group of men 55 to 57 mm., in the Kandyans 62 to 64 mm.

Of the Indians, Murugappa measured 30 mm., Pichchai only 55 mm. Both showed a somewhat elongated, almost narrow, still straight, palpebral opening. Concerning refraction, sharpness of vision, and colour blindness, Herr Kotelmann has given details.

I now come to the shape of the head. From the tables attached it will be seen that of the seven Siṇhalese, there were :—

Two brachycephalic, four mesocephalic, one dolichocephalic.

Brachycephalic were Lúsa Nóna (82·7) and her brother Andre Appu (83·5) ; dolichocephalic, on the contrary, her husband Girigóris (72·3). Next to him stand among the mesocephalic the sister Iṇga Nóna (75·8) ; whilst the little son Jimmy (79·6) must be classified among the brachycephalic. The average cephalic index for the whole family may be set down at 78·7, the same mesocephalic number which was obtained from all the seven measurements. The Paris Commission (Dep. 719) measured seven men, five women, and two children. Among these fourteen persons none were dolichocephalic, eight were brachycephalic, six were mesocephalic. As also here among the mesocephalic a high index number appeared, it follows that the average is brachycephalic, viz., 81·9. Both averages, that of Berlin and that of Paris, approximate each other, but it must be distinctly remembered that they were obtained from different persons.

These results stand in strong contrast to those obtained from any examination of Siṇhalese skulls hitherto made. I have described these in my treatise (page 73 and the follow-

ing) in detail, and with every care. After eliminating all doubtful skulls, I had fourteen left. These had a mean index of 71·8, a distinct dolichocephalic measurement; nay, there was not among them a single brachycephalic, not even a mesocephalic skull. On account of this peculiarity I refer here to my writings, and I have no reason to doubt the correctness of the results then obtained. The results obtained by the measurements of skulls of these living persons cannot be made to agree with those obtained by me from the skulls formerly measured, even making all reasonable allowances and corrections.

There remains a want of agreement not to be for the moment reconciled. Either the type of the Siṇhalese skull is not dolichocephalic as I assumed, or the living Siṇhalese, even including Girigóris Appu, were not pure Siṇhalese.

The latter appears for the moment more probable than the former, because in the first place it is difficult to explain where these Ceylon dolichocephalic skulls could have come from if they were not Siṇhalese, as I have already proved (page 91) that the mean cephalic index of Tamil skulls from Ceylon hitherto examined is mesocephalic, viz., 76·3. If one therefore were inclined to conclude with the Paris Commission that these persons were fair Tamils (Malabars), a more satisfactory explanation would be obtained.

Now, however, I would accept such an explanation with the greatest reserve.

The opinion that the Siṇhalese is a mixed race is very old, and a descent from the Malays and Mongolians has been surmised. More details on this point will be found in my treatise on the Vẹddás, on page 110 and following pages. I will only add that should in reality a large portion of the Siṇhalese turn out brachycephalic or high mesocephalic, the question of the relations with Indian races would acquire a greater significancy than I have been hitherto inclined to accord it. Discussing the examinations of the

Chittagong races made by Herr Riebeck, some considerations of this kind occurred to me. (His travels will shortly appear.)

A second point of difference appears in the auricular index. From the appended tables, it can be seen that only dolichocephalic Girigóris and the low mesocephalic Iṇga offer a smaller number for the auricular index, the former 60·6, the latter 64. All the other Siṇhalese have high numbers, the highest Lúsa Nóna (72·6). One may therefore conclude that the majority of the persons are hypsocephalic. This also corresponds more with earlier numbers (pages 92–140) found by me in Tamils, than with those for Siṇhalese.

A third point is the breadth of the brow, which, making all allowances for the fleshy portion, is, in all the Ceylonese measured by me, more considerable than any measured in Siṇhalese, and even in Tamil skulls.

Whilst the highest measurement of the skulls only amounted to 93 mm., the lowest measurement among the living was 98 mm. (Lúsa Nóna), and the highest 109 mm. (Puñchi Baṇḍá). This great breadth of brow contributed not a little in improving the appearance of the persons in question. In the Kandy people the forehead was high, from 70 mm. to 75 mm.

Girigóris was 67 mm., and Andre only 55 mm., less than even the women showed (58 mm. and 59 mm.).

As far as the face is concerned, I have confirmed the opinion that the Siṇhalese are not prognathous. With the exception of one woman, they were all orthognathous, and had a small mouth, although the lips were full and the front teeth large. In several it seemed to me the lower lip was comparatively strongly prominent, whilst the teeth showed a peculiar mother-of-pearl brilliancy, in which a loss of enamel forming a hollow in the crown occurred. I looked upon this at first as artificial, but according to their own assertion it arises spontaneously. It seemed to me, however, as if the mode of cleansing their teeth caused this loss of enamel. I add here a few special particulars :—

1. Ukku Baṇḍá: Mouth small, 50 mm.; lips full, but only moderately prominent, mostly the underlip, which looks bluish internally, but does not allow any peculiar pigment to be seen; teeth greatly worn.

2. Puñchi Baṇḍá: Mouth large, 55 mm.; lips full, underlip strong, livid bluish colour, but little pigment in the mucous membrane; teeth large, particularly the upper incision, much worn.

3. Girigóris Appu: Mouth 51 mm.; lips full, quite blue; pigment in the gums; teeth (above) large, shining, much worn.

4. Lúsa Nóna: Mouth 44 mm.; lips full, but short, red, no pigment in the mucous membrane; teeth, large, straight, brilliant, like mother-of-pearl, worn, with a hollow in the right middle incisor in the enamel.

5. Jimmy: Mouth 34 mm.; lips thick, but only the underlip prominent.

6. Andre Appu: Mouth small, 44 mm.; lips full, somewhat bluish, but not pigmented; upper lip short, not prognathous; teeth large, brilliant, like mother-of-pearl, with several hollows in the enamel; chin delicate, round, and prominent.

Indians:—

1. Murugappa: Mouth large, 61 mm.; lips full, especially the underlip, which from a full supply of blood and pigment has a dark bluish-brown appearance; on the gums a brownish stripe parallel to the edge, but still separated from it.

2. Pichchai: Mouth shorter, 52 mm.; lips full, upper short, underlip advancing, blue; the gums pigmented; teeth large, much worn.

The face index was in all chamæprosop (broad face), with the exception of Girigóris Appu, who gave a leptoprosop (long and narrow face) measure, 91·3. His long face had, as Herr Becker has remarked, a semitic touch. Andre Appu's face appeared longish: still, this was more due to the fact that it contracted very much below. The faces of the women were short, broad, and more rounded, with somewhat prominent cheek-bones. The noses also differed from descriptions

hitherto given. The oldest descriptions by the Chinese (*cp.* Vedd. Book, page 61), ascribed to the Ceylonese a "bird's beak," yet many forms appeared to us amongst these people, as the index numbers will show. Girigóris' nose was the most prominent. His nose index amounted to 68·6. The two Kandyans followed with 71·1 and 71·6, then Iṇga Nóna with 76·1; on the contrary, Lúsa Nóna 83·7, her brother Andre 88·8, and the little Jimmy 90·9. This last group also includes the two Indians, with 80·0 and 83·3.

The French Commission obtained similar results: three men and two women had an index over 83. Three men and three women under 74 (among these one 64·4, one 66·6, one 68·5, one 68·7, and one 69·2).

I add here a short description of their noses :—

1. Girigóris Appu : Nose strongly projecting, ridge curved, point prominent (snub ?), alae small and narrow; a decided semitic expression.

2. Ukku Baṇḍá : Nose strongly projecting, straightest of all, sunk at the root, ridge slightly curved, point thick, alae not large.

Puñchi Baṇḍá : A nose strongly inclined to but not quite an "eagle nose," somewhat curved, point prominent, looking downwards, alae moderately wide apart.

4. Lúsa Nóna : Nasal ridge curved, short, point thick, overhanging; alae wide apart, somewhat flat; nostrils large.

5. Jimmy : Nose short, bent, point thick, projecting; septum short; alae very broad and full.

6. Andre Appu : Upper portion of nose thin and small, somewhat curved, point projecting, alae wide apart.

Davy has given us a poetical description of a Siṇhalese beauty (Vedd. Book, page 63). The nose is described in it as a "hawk's beak." Our ladies had nothing of that, yet it seems as if such faces had not quite died out. The cabinet photograph of a Siṇhalese beauty, which Herr Hagenbeck has presented to me, shows such a nose, and we can only regret not having seen the original.

In the Indians I found the following: Nose on the whole straight, but small and narrow, towards lower part wider, even in the bony part; point little developed; septum little projecting; alae very broad, 46 mm.

As a conclusion to this discussion of the shape of the face, I mention that the ear, as a rule, was delicate, and in many cases small. In three persons, viz., Lúsa Nóna, Andre Appu her brother, and the Kandyan Ukku Baṇḍá, I noticed that the lobule was adherent to the side of the head. This was also the case with the Indian Pichchai. The body was strongly built in all cases. The Kandy men alone attained to a good height. Puñchi Baṇḍá 1,745, Ukku Baṇḍá 1,674; Girigóris and Andre Appu measured only 1,576 and 1,583 mm., the women 1,425 and 1,451 mm. Travellers have given five feet four, five, six, or seven inches = 1,626 to 1,702 mm., as the average height of the men. The French Commission give only two measurements, 1,596 and 1,576 mm.

The family (Abu Nóna) appears to be, from this, unusually small. Girigóris is at the same time thin, his calves are but little developed, notwithstanding which he is a tree-climber by profession, and climbs with the greatest ease the highest tree. Andre is also thin, but nevertheless of great strength. Lúsa Nóna, although said to be only twenty-five years old, makes a pleasant impression, but is yet aged; she has a delicate build of body. The little Jimmy, on the contrary, is a fat, chubby-cheeked boy of unwearied activity, but truly a little glutton. His shining blackish-brown body corresponds exactly with the description given by Emerson Tennent of Siṇhalese children: "They looked in their nakedness like living bronzes." Iṇga Nóna is sixteen years old, very light, small, and fat; her form is quite round, her bosom prominent, and her thick cheeks swell still more prominently when she laughs.

Puñchi Baṇḍá has a proud-looking figure, with full form and strong muscles. He looks older than twenty-four years, the age assigned to him. Ukku Baṇḍá is also strong and muscular.

For dynamometric measurements, I refer to the report of the Paris Commission.

The ratio between the measurements round the hip and the height of the body showed such great differences, that I thought at first on revising my notes,—I had made some mistakes. The measurements were in all cases greater than the height of the body: even the women showed differences of 67 and 57 mm. Among the men the difference is more striking: Girigóris Appu had 82, Andre Appu 123, Puñchi Baṇḍá 60, Ukku Baṇḍá 118 mm. of a difference. The differences in the lengths of the arms are not less striking: Girigóris 732, Andre 761, Puñchi 806, Ukku 784 mm.

Shoulder-breadths measurements:—Girigóris 340, Andre 376, Puñchi 395, Ukku 391 mm. These are comparatively not widely diverging numbers. The circumference of the chest was considerable, greatest in the case of Ukku Baṇḍá, viz., 925 mm. The women have, on account of the full development of the breasts, a larger circumference than the men; the lengths of the lower extremities vary also. The height of the trochanter in Puñchi Baṇḍá amounted to 934 mm.—that was the largest number: the smallest was Andre Appu, 840 mm.; but the ratio is everywhere the same in men and women, *i. e.*, the height of the trochanter is to the height of the body as 1 to 1·8.

The shape of the hands and feet was uncommonly elegant, especially that of the feet. The Kandy men wore leather shoes, and although these were comparatively loose, still the small toes were pushed somewhat inwards, and this was even noticeable also in the next toe. Girigóris wore sandals, and had a wide divergence between the great and the second toe. Nevertheless, his feet also appeared comparatively natural. In the rest the shape of the foot was free from artificial deformities. I do not remember ever having seen such naturally shaped feet. As is well known, the feet among nations wearing shoes or boots are exposed from the earliest years to so much pressure, that a naturally-formed foot

is only seen in the case of the newly born, or in children of tender years. Even sandals when constantly worn press the toes together, and cause a permanent deformity very soon.

One seeks in vain among marble statues for a regularly formed foot. Even the gods of the Greeks have their small toes laterally compressed. Here, however, I was overjoyed to find feet with perfectly natural shapes. As their stay in Berlin was to be short, I begged Herr Hagenbeck to have a selection of casts of hands and feet made for me in Hamburg, and I am in the fortunate position to be able to lay before you good models of these. For this I have to thank Herr Hagenbeck.*

In the first place, there is a strong contrast between the feet of the Siṇhalese and that of the Indians. This is partly due to the general development of the body. The ratio between the length of the foot and the height of the body is in all three the same, viz.: in the men as 1 : 6·6; women, 1 : 6·5. But the development of the feet is quite different. In Murugappa the whole foot is heavy, bony, and broadly developed, whilst in the Siṇhalese the foot is delicate, thin, and narrow. The breadth-index of Murugappa is 40·5, of Girigóris 36·8, of Lúsa Nóna 28·2. The Paris Commission found among the men indices of 39·5 to 44·3; among the women 36·5 to 40·6.

In all, the toes were very movable, and they were capable of diverging widely at will. On this depends the safety in climbing,—which is possessed by Girigóris to a wonderful degree,—and the capability to seize objects with their toes. As seen from the illustration,* the divergent position in the

* Illustrations of a few of these are annexed to the German text. The views of them are taken laterally and from above, and designed with the greatest care by Herr Eyrich, one-sixth their natural size. No. 1 is the foot of Lúsa Nóna, No 2 that of Girigóris Appu, and No. 3 that of Murugappa, one of the Indians. The cast of the foot of Iṇga Nóna is not given, nor the casts of the hands of any of the troupe.

case of Murugappa is well shown; in the case of the Sinhalese to a much smaller degree. In all cases, however, is seen the great interval between the great toe and the others, especially in Murugappa. The three middle toes form a group by themselves.

At the same time, one may notice the length of the toes of this middle group, especially of the second. The Sinhalese have these toes almost in the shape of fingers, straight and long. Murugappa, who also has short and thick fingers, shows also short toes, thick and plump; and the great toe is so widely divergent as to project but little over the second. Among the women, the second toe projects beyond the first, notably in Inga Nóna, whilst in Girigóris the corresponding toe is shorter. This is strongly developed in Andre Appu. The terminal phalanx of the great toe is very broad in all cases; the smaller toe is very short. The middle of the foot is small, thin, and straight. It widens gradually up to the heads of the metatarsal bones, where it, in comparison with a foot accustomed to shoes, appears strikingly broad. Notwithstanding this the great toe has no proper ball; externally the little head of the fifth metatarsal bone is somewhat prominent. Further back the external border runs uniformly, whilst in the inner border rises quickly, forming a well-marked arch. The heel is strong and firmly set. The span of the foot is high and delicately arched, especially behind the first metatarsal bone. The tarsal bones are strong, little prominent, and very high. In Murugappa the height above the ground is 59, in Lúsa 46, in Girigóris 48, in Inga 54, and in the two Kandyans 61 and 65 mm., respectively.

With this I finish the analysis to which this interesting company has given rise. Without as yet classifying the subjects of my discourse, I dare to hope that the communication as it stands will be a sufficient excuse that I do not come to any definite conclusion. How many of the differences observed are merely due to the individual, how many are due to race-difference, I cannot satisfactorily say. Take an

example: according to my earlier craniological examinations, the Siṉhalese are dolichocephalic. Now, among the people actually measured by me here, I find only one dolichocephalic, viz., Girigóris Appu, the same whom Herr Becker took for an Arab. In reality his face, particularly his nose, had a distinct semitic look. But the Moormen are now-a-days Muhammadans, and if in rare cases they mix with the Siṉhalese (see my Vẹddá Book, page 94), it does not follow that they also change their religion.

Besides, the Jewish face appears among so many of the inhabitants of the islands of the East, that I would not support such a supposition on that ground. Also the deduction drawn by Herr Becker from the name *Abu* is so uncertain, as I have already shown, that it proves nothing. If Girigóris is not an Arab, he must be considered as a typical Siṉhalese. If this is accepted, then the others measured by me are not typical: even the stately Kúruwe from Kandy, and least of all the woman Nóna. Their short and broad skulls, their chamæprosopia (broad faces), and in particular their broad-pressed-in-curved noses, with the alae wide apart, point with a strong probability to a mixture with the Tamils.

The little Jimmy resembled his father so little, that one felt almost inclined to disbelieve the relationship. He was, however, the very image of his mother. His roundish-square head, his full-moon face, his ape-nose were only exaggerations of the mother-type. But the colour of the skin was quite dark, whilst the mother's was light. Who can doubt but that here individual and sex peculiarities were recognisable? but where is the line of demarcation of ethnical peculiarities? Unfortunately there is still wanting an exact description not only of the Ceylonese Tamils, but also of the Indian Tamils. I have therefore earnestly requested Herr Hagenbeck, in case he should again bring such people to Europe, which is not at all unlikely, to bring well-authenticated Tamils. One thing seems to me certain. If the French ethnologists entertain the opinion that the dark-skinned races of India

originated from Negritos, it is most probably a mistake. The Negritos known to us have that woolly hair which consists of small, close, spiral rolls, quite similar to the Blacks of Africa, and not only to the Niger proper, but, as lately discussed, also to the Caffirs and the other Bantu nations. In the case of the Africans, each spiral roll is so hard that it feels like a solid body. In the case of the Negritos the rolls are somewhat soft, from the fineness of each individual hair. Our Ceylonese show the very opposite of this. They are in the plainest meaning of the term smooth-haired, without the shade of a curl; the beautiful appearance of their long black hair is certainly improved by the care they bestow upon it, but no Negrito is capable, so far as we know, by any amount of care to change his hair in a similar manner.

Even the Dravidian Indians have nothing of the Negrito hair. One must therefore look to other sources than this, and it is possible that they are a very mixed race. As far as language is concerned, the Siṃhalese must be referred to an Aryan origin. Their history favours this idea; but are, on this account, Mongolian and Malayan connections to be excluded? I cannot believe it; at all events, I can say that many among the people presented to me, especially among the women, seem to point to Eastern relationships, and that if these people are really Siṃhalese, without any fresh mixture of blood, then must the Siṃhalese race be looked upon as a mixed race in the highest degree.

Sin̥halese and Indian.	Sin̥halese.							Indians.	
	Girigóris Appu. ♂ 29 J.	Lúsa Nóna. ♀ 25 J.	Jimmy (Sinni). ♂ 3 J.	Andre Appu. ♂ 21 J.	In̥ga Nóna. ♀ 16 J.	Puñchi Banḍá. ♂ 24 J.	Ukku Banḍá. ♂ 22 J.	Muru-gappa. ♂ 32 J.	Pichchai. ♂ 19 J.
I.—Head Measurements.									
Greatest length	188	168	167	182	178	189	186	196	183
Greatest breadth	136	139	133	152	135	150	145	147	147
Height of ear	114	122	110?	123	114	128	125	128	127
Breadth of forehead	98	106	88	104	100	109	101	104	107
Height of face, A	138	162	130	169	162	181	186	193	163
Height of face, B	116	103	81	114	104	111	111	119	106,5
Height of face, C	71	63	40	69	62	70	70	73	66
Breadth, *a* jugal	127	129	110	134	125	137	132	144,5	134
Breadth, *b* malar	87	75	59	87	86	87	94	95	89
Breadth, *c* mandibular ...	101	97,5	86	100	90	104	93	106	102
Interorbital, *a*	35	31	28	35	31	35	34	37	39
Interorbital, *b*	90	91	78	92	91	99	96	107	94
Nose, height of	51	43	33	45	42	53	52	50	48
Nose, length	51	41	27	39	35	45	48	46	41
Nose, breadth	35 (36)	36 (38)	30	40 (44)	32 (34)	38 (39)	37 (39)	40	40 (41)
Mouth, length	51	44	34	49	45	55	50	61	52
Ear, height	56	50	46	52	59	60	59	69	55

Siṇhalese and Indian.	Siṇhalese.							Indians.	
	Girigóris Appu. ♂ 29 J.	Lúsa Nóna. ♀ 25 J.	Jimmy (Sinni). ♂ 3 J.	Andre Appu. ♂ 21 J.	Iṇga Nóna. ♀ 16 J.	Puñchi Baṇḍá. ♂ 24 J.	Ukku Baṇḍá. ♂ 22 J.	Muru-gappa. ♂ 32 J.	Pichchai. ♂ 19 J.
II.—Body Measurements.									
Body, height	1576	1425	769	1583	1451	1745	1674	1657	1613
Hip	1658	1492	—	1706	1508	1805(?)	1792	1815	1723
Breast, circumference... ...	800	825	—	830	855	900	925	900	790
Shoulder, breadth	340	322	—	376	330	395	391	388	349
Shoulder, height	1314	1199	—	1330	1214	1482	1404	1375	1334
Elbow, height	1008	912	—	1022	948	1142	1083	1042	1024
Wrist, height	743	670	—	744	730	866	810	753	752
Middle finger, height... ...	582	520	—	569	572	676	620	588	594
Nasal, height	971	—	—	990	—	—	—	970	981
Trochanter, height	863	758	—	840	789	934	901	887	878
Knee, height	463	412	—	481	450	540	534	488	500
Malleolus ext., height... ...	48	46	—	49	54	65	61	95	61
Hand, length	170	155	100	190	160	182	188	179	175
Hand, breadth	75 (100)	70 (86)	50	81 (94)	75 (95)	94 (100)	89 (102)	59	85 (95)
Foot, length	236	216	136	250	224	260	276	249	240
Foot, breadth	87	81	60	97	86	102	100	101	91
III.—Berechnete Indices.									
Langenbreitenindex	72,3	82,7	79,6	83,5	75,8	79,4	78,0	75,0	80,3
Ohrhohenindex	60,6	72,6	65,9?	67,6	64,0	67,7	67,2	65,3	69,4
Gesichtsindex	91,3	79,8	73,6	85,0	83,2	81,0	84,0	82,3	79,4
Nasenindex	68,6	83,7	90,9	88,8	76,1	71,6	71,1	80,0	83,3

OUTLINE OF TWO YEARS' SCIENTIFIC RESEARCHES IN CEYLON.

BY DRS. C. F. AND P. B. SARASIN.*

(Read February 16, 1886.)

IN the short space of a report it will naturally not be possible to enter into any details: we can simply give a few results which seem to us to be of interest. Further, we must omit to refer to and compare notes with works already published on the different objects we speak of: this we reserve for our future publications in Europe, of which copies will be sent to the Society.

I.—ANTHROPOLOGICAL.

We begin with some anthropological notes, and shall later on refer to our chief branch of study, zoology.

We did not intend, when we came to Ceylon, to make anthropological investigations; but as the races in this Island proved of the highest interest, we could not but spend a part of our time in examining them. During our journeys, in which we traversed the Island in nine directions, we acquired a great deal of information on this subject.

As is very well known, Ceylon contains three principal races, the Siṇhalese, the Tamils, and the Vẹddás. There are others, whom we may dismiss with a brief remark; for instance, the Moors, more or less casual inhabitants, Arabian

* In offering this Paper to the Ceylon Branch of the Royal Asiatic Society, we wish to express our best thanks for the kindness shown to us by this Society in presenting us with an almost complete series of the Society's Journals. Besides, we owe a debt of gratitude to many individual Members for the ready assistance they have been good enough to give us in our exertions, and to which we think we cannot reply in a more appropriate way than by laying before you a preliminary report of our researches.

merchants, who settle in every trading place of the East. In a very few parts only the Moors have their own villages, chiefly so in the Batticaloa district, where they form about one third of the inhabitants. The Afghans, Malays, Kaffirs, Parsees, &c., are of no importance for our purposes.

The two races, Siṉhalese and Tamils, are not living side by side in the same districts, as is often believed; such is only the case in the large towns and upon the hills, whither the Tamils are imported as coolies by the planters. Generally speaking, the Siṉhalese inhabit the hilly zone and the fertile and wet Western and Southern Provinces; they attain their greatest density, according to the census of 1881, in the district of Colombo; they are very scarce in lower Uva, in the North-Central Province, and in the northern parts of the Kurunẹgala district.

The Tamils, on the other hand, with the exception of those in the planting districts, live on the eastern coast of the Island. They are numerous in the Batticaloa district, less so in the district of Trincomalee, almost wanting on the coast north of Trincomalee. The real centre of the Tamils, however, is the densely populated Island of Jaffna, where they live to the exclusion of every other race: even the ubiquitous Moor is very seldom met with. Maṉṉár and Puttaḷam, further on, are Tamil places, and south of Negombo there is an old Tamil colony, which has existed since the time of King Gaja Bahu I. (113 A.D.).

It would be erroneous to suppose that the districts of Siṉhalese and Tamils are adjoining each other: this is only the case in very few places, as, for instance, north of Chilaw. Otherwise, a broad belt of forest land separates the Siṉhalese countries from the Tamil ones. This belt, which is almost uninhabited, and in many parts completely so, begins to the east of Saffragam (Sabaragamuwa), maintains a breadth of 20·30 miles adjoining lower Uva, and expands to about forty miles in Tamankaḍuwa. This separating belt increases to a breadth of about sixty miles in the northern parts of the

Island: almost the whole Northern Province is without any cultivation, and therefore the Tamil Island of Jaffna is separated by an enormous rampart of forest from the Siṇhalese districts, even more so than the Tamil coast of Batticaloa.

We learn in the histories of Ceylon, and observe it at the present time, that Siṇhalese and Tamils intermarry sometimes. We know, even, that many kings of Ceylon have been of Tamil blood; but notwithstanding this, a certain mutual aversion of the two races is not to be overlooked, and it is just that aversion which proves that a deep difference of race is existent. We learnt, for instance, in Trincomalee, that no Siṇhalese will die in that Tamil place, but as soon as one gets ill he returns to his native country; and other facts still further illustrating this aversion could be mentioned.

The enormous belt of forest just mentioned, and the open park country the solitude of which is only interrupted by relatively few small villages, and very seldom by large patches of cultivated land, such as near the lake of Kantalay and round other smaller tanks, is the abode of the Vẹddás. They live in the eastern part of Ceylon, and are the remnants of a tribe which deserves our attention in a very high degree.

We arrived too late for the exploration of this tribe. The original wild Vẹddás are extinct,—at least, beyond some quite incredible rumours, we could not find any traces of them during the three months which we spent in searching for them in the remotest parts of the Island. All the Vẹddás have been induced to leave the rock-caves, their old natural dwellings, and to settle in small villages under the charge of the headmen of the adjoining districts. The purest Vẹddás we found are living in the Nilgala district, and near Bintẹnna; others near Mahá-oya, in the Eastern Province, and in the Friars-hood range. But even these are already so accustomed to Europeans by their frequent visits to Kandy and Badulla, and by the hunters who have been to see them, that the Nilgala Vẹddás, for instance, as soon as

they saw us coming, began to dance and to sing, and tried to tell us incredible stories. The settlement of the Vẹddás in villages gives naturally much occasion for mixing with other elements; many Siṇhalese villagers marry Vẹddá wives, and therefore, all the intermediate types between Vẹddás and Siṇhalese are to be met with. In many villages of lower Uva, where Vẹddás are already completely extinct, the traces of old Vẹddá blood are easily noticed in the features and in the dark colour of many a Siṇhalese villager.

Similar intermarriages, or those which happen in the Siṇhalese districts, are taking place on an even larger scale in the Tamil countries. On the east coast, north of Batticaloa, there are many villages, and Vẹddás have been induced to settle; and in these places the mixture of Tamils with Vẹddás is conspicuous. In this way the Vẹddás will disappear completely at a not very distant time; already, according to the census of 1881, there are not more than 2,228 individuals who still call themselves Vẹddás. The race is not dying out, as is generally believed, but is being absorbed by intermarriage with the surrounding tribes.

Our chief object was to ascertain whether the three races of Ceylon are really so different from each other that they could be distinguished by anatomical characters, or whether the differences between them were so insignificant that no positive result could be obtained by a careful comparison. A great obstacle to our purpose was necessarily the frequent intermarriages of the three tribes, which often left us in doubt whether the men we examined were of pure blood or not. The only way to obtain a satisfactory result was therefore to collect as large a number of skulls as possible, and to take measurements of numerous specimens of each race to compile averages. Thus we collected nineteen skulls of Vẹddás, fifteen of Siṇhalese, and fifteen of Tamils. We dug them all up ourselves,—with the exception of some Siṇhalese skulls,—and thus are sure that no confusion has arisen. We found no time during our stay in Ceylon to

examine these skulls,—we shall do so in Europe,—and therefore are now able to speak only of the results which we obtained by measurements of living individuals. Many of these measurements will have to be compared with those of skulls where alone measurements can be taken with mathematical exactness.

To begin with the height, we found the Vẹddás to be the shortest of the three races. Vẹddás of Maha-oya had an average height of 1,541 mm., eight from Nilgala 1,575, thirteen coast Vẹddás north of Batticaloa 1,591 mm. After these, range twenty-two Siṇhalese with 1,624 mm., and finally, as the tallest, the Tamils, of whom twenty-five have been measured with 1,652 mm. of height on the average. The size of the head does not at all correspond with the height, as the largest head does not belong to the Tamils, but to the Siṇhalese; and this fact is in accordance with the higher intellect of the latter. In size of head the Tamils range after the Siṇhalese, then the coast Vẹddás, and by far the smallest heads are those of the Vẹddás in the interior. The coast Vẹddás contain, as already mentioned, many Tamil elements, and therefore in a number of measurements range between the Tamils and the other Vẹddás.

It may be interesting to point out in which measurements the principal differences are found. Firstly, the height of the face, that is the distance from the notch of the nose to the chin, is with the Vẹddá the smallest (105 mm.) on the average; it is larger in the Tamil head (111 mm.), and largest in the Siṇhalese (115 mm.), and this difference gives to the whole face a different appearance.

Secondly, we have the diameter of the back part of the skull, or the distance between the two mastoid bones, in the Vẹddá only 124 mm., in the Tamil 130, and in the Siṇhalese 132. The head of the Vẹddá is therefore in its back part narrower than the head of the two other races, and especially of the Siṇhalese, and we have strong reasons to suppose that the brain of the Vẹddá is likewise much

smaller than that of the Tamils, and still more so than that of the Siṇhalese.

Thirdly, the lower jaws of the Veddás are much narrower than those of their neighbours. A fourth difference is found in the size of the eyes, as the Veddás have the largest and the Siṇhalese the smallest eyes of the three, the Tamils ranging here also between the two others. The differences in this last measurement are naturally very small, but still noticeable.

One of the most striking features in the face of the Veddá is the shape of the nose; firstly, it is very broad, 40 mm., while with the Siṇhalese it is only 39 mm., and with the Tamil 38 mm.; secondly, the bridge of the nose between the eyes with the Veddá is in most cases very low, sometimes almost flat. This fact gives to the Veddá nose a strange shape, and strikingly influences the features: the bridge is higher with the two other races. The Siṇhalese have often very well-formed eagle-shaped noses.

Besides these peculiarities of the Veddás already mentioned, shortness of face, narrowness of the back part of the skull and the lower jaw, largeness of the eyes, and lowness of the bridge of the nose, we could mention more differences in the measurements of the head; but it would lead us too far for the present, and we think it sufficient to show that such peculiarities do exist, and are to be traced by measurement. The results which we shall obtain by comparison of the skulls, we shall be glad to lay before this Society after our return to Europe. Taking exact measurements of the limbs is still much more difficult than measuring the head, and of the results obtained we venture only to specify now the following one as fairly well established. The lower arm of the Veddá and also of the Tamil is relatively a little longer than that of the Siṇhalese.

The colour of the Veddás is always a dark and dirty chocolate brown, a colour which is likewise frequently found with Tamils, but seldom amongst Siṇhalese.

Summing up, we learn by the measurements that the Siṃhalese, Tamils, and Vẹddás are three well-distinguishable races, and further, the measurements give much reason to suggest that the Tamils are more closely allied to the Vẹddás than the Siṃhalese, which latter no doubt represent the highest race, whilst the Tamils in many respects range between the two others.

One result in any case is certain, viz., that the Vẹddás are by far the lowest in the scale of the three races, not only in their habits, but also in their anatomy, and this fact confirms the opinion of those who claim the Vẹddás as the remnants of an old tribe of Aborigines. We can pass over the customs and the religion of the Vẹddás, because former writers have dealt with them, and the principal facts are generally known. We will call attention to one point only, because it illustrates clearly the primitive customs of this race, and that is the wearing of leaves as a cloth. A string is tied round the loins, and small branches are put underneath, till a thick belt of leaves is formed. This custom is now almost extinct by increasing civilisation, but almost every Vẹddá, if requested to do so, will appear in a few minutes in his dress of leaves.

It is our intention at a later period to deal more exhaustively with the anthropology of Ceylon, and to illustrate our writings by maps and photographs. We therefore confine ourselves in the meantime to these preliminary notes.

II.—Zoological.

As zoologists, our labours in Ceylon were naturally devoted to the study of animals. Before we came to this Island we had set ourselves the special task to discover the development, then entirely unknown, of *Epicrium glutinosum* = *Coecilia glutinosa* (Linn.). This is a kind of ground snake, living in the tropics of the East, and known long since; the shape of the animal is like that of an eel, one to one and a half feet in length, dark brown in colour,

with two yellow side-bands. The skin is lubric, like that of a frog or a salamander. It lives under the surface soil near rivulets or ponds, in cavities which it digs for itself. Its eyes are small; there are no feet. Two tentacles, which are at the top of the snout and are retractile, are very remarkable; further, the skin is particularly interesting, because there are imbedded in it numberless very small round scales like those of fish, but invisible from the outside, and also different from the fish scales in their finer histological composition. The genus *Epicrium* has some few relatives in America, which bear the old name of the whole class, viz., *Coecilia.*

It is but natural that this animal should excite the greatest interest of naturalists, and that many efforts have been made to arrive at a clear knowledge of its position in the natural system. The conclusion arrived at was, that it ought to be ranged under the order of the *Amphibians*, and not, as it was supposed formerly, under that of the *Reptiles*, especially of the snakes. Later on, as there have been found different anatomical peculiarities which pointed out a somewhat isolated position of the animal, it was raised to a special order, that of the *Assoda*, and was put in the lowest rank of the general class of the *Amphibians.*

We know from experience, that if the position of an animal in the natural system is not clearly understood, its development throws light upon the question, the animal in its development showing the traces of those forms which it had to run through, according to the theory of evolution, to arrive at its present form. We know, for instance, that the well-known water-salamander (*Triton*) is an animal which for some time of the year lives on land, and breathes through lungs; it lays its eggs in the water, and out of them come forth larvæ, which have at each side of the head near the ear a bundle of gills. Feeding in the water the animal gradually obtains lungs, the gills atrophying, and finally dropping off; it then seeks land, and

breathes air. Now, the question is this: Does *Epicrium* show the same mode of development as the water-salamander, or not?

It was known that the order *Epicrium* has been found living in the water, and at each side of the head, where gills were expected to be, they had little openings. But this was all that was known about the development of *Epicrium*. Here began our work. It was evident that we had two suppositions: Either, *Epicrium* lays its eggs in the water, and there the young ones take their development (as is the case with the salamander), or *Epicrium* is viviparous. So we carefully examined all ponds and rivers in the vicinity of which we found the full-grown animals, but though we often met with young specimens living in water, with a gill-hole at each side of the head, yet we never found gills, but always well-formed lungs; earlier stages did not come to our notice. So we began to dissect the full-grown animals, and to examine them for embryos; we opened about a thousand females, yet we never obtained the result so much wished for. At last a cooly brought a little lump of eggs, which he had found in the ground near a rivulet, and from this moment the mode of development was discovered, which generally proceeds in the following manner:—The pregnant female forms in the soft damp soil at first a small globular cavity, and deposits there a lump of about thirty pretty large eggs, connected with each other by a sort of string. The mother curls herself round the eggs, and broods probably in order to keep them damp with her body in the case of sudden drought. The eggs are of the size of a very large pea, and yellow, bearing a close resemblance to those of reptiles, the lizard for instance; in size, therefore, they cannot be compared to the eggs of a frog. In such an egg an embryo develops, which is especially interesting owing to the circumstance that behind the eyes, on the same spot where the salamander has them, three long gills are growing, of which one is directed forward, one upward, and one

backward. The gills have the shape of ostrich feathers, and as they are red like blood, the embryo, after being artificially freed from the egg, looks really pretty. Its colour is black, but the yellow yolk adheres to the belly. This shows that the *Epicrium* whilst in the egg passes through the same stages which the salamander passes through in the water. In the salamander, the reason for gills is clear: they serve the young animal to breathe in the water like fish; in *Epicrium*, the gills are as well formed as in the salamander, but as they are not required to act as breathing organs under water, their existence is not so easily understood; yet they are perhaps of some importance as organs of breathing of the embryo in the egg. The embryo remains in the egg for a very long time, until it reaches the size of about six to seven centimetres; it also moves rapidly if at that time it is artificially freed and put into water. The next thing we observed was the young *Epicrium* living in water with two gill-holes, but without gills; the size of the youngest was only a little larger than the full-grown embryos. It is therefore certain that the embryos break the shell of the egg, strip off their gills when wandering through the soil to the water, and live for some time in water with simple gill-holes and lungs, which had developed already in the embryonic stage. A young *Epicrium*, or so-called larva, when living in water comes from time to time to the surface to inhale air. By and by the gill-holes close, the young animal appears on land, and no more leaves it; when put back into the water it is soon drowned.

It now would no longer be correct to assign to the *Epicrium* the lowest position in the natural system amongst *Amphibians*. The *Epicrium* has generally the same development as the salamander, and has therefore its position quite near the latter. The salamander belongs to the *Amphibians* with a tail, in contrast with the frog, which is a tailless *Amphibian*. The *Epicrium* was considered to be without a tail; in the full-grown specimen, however, a trace

of a tail is discernible, and the embryos show clearly a short tail with a well marked fin. These are the main features of the development of *Epicrium*. There are many other points of interest, but they come more into the scope of a specialist, and could not be explained in a short paper and without the aid of drawings, and they will have to be dealt with accordingly at a later period.

The chief results are briefly—

(1) *Epicrium* (like *Coecilia*), on the basis of its anatomy, cannot be placed in any known group of Amphibians.

(2) Its embryonic evolution passes through the same stages as the salamander as a larva.

(3) In consequence, *Epicrium*, notwithstanding its very different appearance, has to be classed as the nearest neighbour of the salamander.

The researches just referred to occupied us about eight months at Péráde̤niya. We then proceeded to Nuwara Eliya to begin studying the *rain-worms of Ceylon*, both from a histological and a systematic point of view. The hills of Ceylon are of special interest in possessing quite a gigantic species of rain-worm, which attains a length of about four feet, and a thickness of a big thumb. We hoped to find other similar species, but we met only with smaller kinds that were new, amongst which were a beautiful blue-ringed one of rather large size, and many smaller ones of less striking appearance. Ceylon being an island long since separated from the continent, those animals living in the soil, as they are, must be of a peculiar interest, and an exact systematic examination of the rain-worms of Ceylon might induce an investigation of those of India. The comparison of the forms in both countries promises valuable results as to the range of geographical distribution ; it might also furnish a further basis for speculation about the changes of the continents and islands in the course of time. Now, it is true that the rain-worm is very easily transferred in many ways ;

we know already, that upon the different elevations of the hilly zone of Ceylon, different forms are found which are not to be met with in the low country, and which represent probably similar endemic forms, as for instance amongst the lizards in *Ceratophora* or *Cophotis*. It is not the place here to enter into our anatomical and histological examinations of these animals, as they are of too special a scientific interest; but we may mention that a considerable portion of our labour was directed towards the examination of the vascular system of the rain-worm, which we tried to investigate physiologically.

A result of more general importance, which we obtained by histologically examining the skin of *Epicrium* in Pérá-deṇiya, and that of the rain-worm in Nuwara Eliya, is the following:—

The body of every animal, with the exception of the lowest order, as the animalculæ, &c., is surrounded by a more or less thin layer, the so-called epidermis: it is not homogeneous, as glass for instance, but composed of innumerable very small corpuscules, the so-called cells, which are arranged like paving stones. Just under this epidermis the finest branches of the blood vessels are spread like a net. The same is the case in the lungs, and as here the blood comes to a very near contact with the air, it absorbs oxygen and returns carbonic acid; that is the process we call breathing. As the blood is separated from the outer air by the above-mentioned fine skin, the epidermis, the receiving of oxygen and returning of carbonic acid was explained as possible by the physical law of diosmose. But further it was observed that the different cells of the epidermis do not adjoin each other, but that between them a number of cavities exist, and the cells themselves are connected with each other by exceedingly fine communicating filaments. The outer layer of the body was found therefore to be not solid. In the *Epicrium* we observed that from the finest vessels just underneath the epidermis, little tubes ascended outwards, which

after having reached the epidermis, divided into tiny arms like those of a chandelier, and these arms again were connected with the range of cavities between the cells of the epidermis. These cavities communicate with the surrounding medium; so we learned that the fluid of the vascular system communicates by means of the very fine tubes, and the cavities of the epidermis just described with the outside. The tubes are so small that even a blood-corpuscule is much too large to pass through; and further the blood-fluid, the so-called serum itself, cannot flow out of the skin, according to the law of capillarity. We pursued the subject further, and found a similar state in the gills of fishes, the skin of snails, leeches, and rain-worms. This discovery of a direct communication of the vascular fluid with the outer medium, obviates the use of the law of diosmose, and the process of breathing becomes more intelligible. It is to be hoped that injection into the vascular system may lead to a conclusive proof of our theory.

The next five months were devoted to travelling in the south-east of the Island, partly in search of information about Veddás, partly with the object to obtain an embryo of an elephant. His Excellency the Governor had the kindness to give us free permission to shoot elephants, with the special right also to kill females for the aforesaid purpose. But unfortunately our exertions in this latter direction were not successful. Three female elephants were killed, but none had an embryo. Part of the intestines of the animals has been preserved for future histological examination.

During our stay in Ceylon, we used to collect whatever seemed to be important, and thus a fair amount of scientific material has been accumulated, which will be dealt with in Europe after our return. Many new specimens which we were able to secure in the course of our stay we pass over here, because they have not yet been exhaustively examined. However, we shall briefly touch upon the chief results of our four months' stay at Trincomalee.

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We discovered there two snails living as parasites on a sea-star. Until now only very few parasitic snails have been found. The most famous kind is *Entoconctra mirabilis*, which lives in a holothuria, and is an animal that in appearance is only with difficulty to be distinguished from an intestinal worm; but its eggs develop fully-formed young snails with shell, feet, and eyes. This is a new example to show how impossible it is in many cases to understand the systematic position of an animal without the knowledge of its development. The snails examined by us are not so extraordinarily deformed as the *Entoconctra*, yet they have many characteristics. Our two snails are quite different from each other: they are also living on different parts of the sea-star. The one which inhabits the interior of it is about a quarter of an inch long, and has a well-formed somewhat hard shell. Where it dwells, the body of the sea-star is inflated to a spherical cavity, and when the apex of the shell touches the skin of the sea-star, a little hole is formed, which through the interior of the cavity is in communication with the outside. The snail can hardly move, and thus lives like a captive in his cell. The most remarkable feature is, that the mouth of this snail, which is small in other species, is extended into an enormous proboscis, almost twice the length of its body. This proboscis is immovably connected with the inner side of the body-cavity of the sea-star, and through it the snail sucks the fluid of the sea-star as its nourishment. Underneath the shell the snail has a gill, and for breathing it requires sea-water; this streams through the above-mentioned hole into the cell of the snail. The water for breathing has constantly to be renewed, and to render this possible, the following apparatus serves: At the root of the long proboscis rises a bell-shaped muscular fold, which rests with its inner side against the shell of the snail, with the outer side against the wall of the cavity, and which is so large that it covers the shell completely. We have not

watched the function of this muscular bell, but we believe that it very likely works as a pump for constantly renewing the water in the cavity. This snail is most probably to be ranked in the system near the genus *Hylina.*

The other snail lives not inside the sea-star, but upon its skin ; its shell has the shape of a Phrygian. It is like the other, immovably connected with the sea-star, the base of its proboscis being enlarged to a disc, and this being connected with the skin of the sea-star by numberless little folds. It lives like the other on the body-fluid of the sea-star.

The sea-urchins are characterised by a globular hard shell, which is covered all over with spines. The regular sea-urchin has the mouth at the lower pole of the spherical shell, at the upper one the arms. Wyville Thomson was the first to discover a sea-urchin the shell of which was not hard but flexible like leather ; the spines were quite short, only about a quarter to half an inch in length, and surrounded by a thick skin : thus they looked like little clubs. In later years a good number of other specimens have been brought up from the deep sea during the expedition of the "Challenger." In Trincomalee we were lucky enough to discover in a depth of four to six fathoms in the harbour, a beautiful new species of this group. The greatest diameter of the animal was about six inches ; its height not quite two inches. The colour was a dark brownish black, and this ground was covered with small spines resembling clubs, in consequence of the skin around them. Besides, small azure corpuscles on stalks ran in radial lines from the upper to the lower pole, and adorned the sea-urchin like jewels. These corpuscles, as well as the other larger spines, have a most striking peculiarity. If the animal is taken into the hand you feel a pain as of about a dozen bee-stings, which lasts for some three or four minutes, then it ceases completely. The small spines as well as the blue corpuscles turn against everything that approaches, and from a more precise examination, the result we came to

was, that, as is known to be the case with insects, every spine is provided with a peculiar bag of poison, the spine itself being hollow, and the poison flowing out of the bag through it into the wound; the blue corpuscles especially have round the bag of poison a fairly thick ball of muscular substance, and this contracts if the fine spine inside of the corpuscle penetrates into the skin. We have no doubt that a similar apparatus also exists in the other leather-urchins, but it has not yet been determined. It is evident that this soft sea-urchin would soon be destroyed by fishes of prey if it had not the formidable arms just described. This circumstance a small fish availed itself of ; this little animal, which is in length about one inch, lived just between the spines of the sea-urchin, so that a pursuing fish could not come near it at all without being wounded by the spines of the sea-urchin ; moreover, the little fish had the same dark brown colour as the sea-urchin, and was thus doubly protected.

Until now in no sea-urchin had a real eye been found. It was noticed that many had a very feeble perception of light ; but it was impossible to state that they could really see. This is quite correct of the great majority of the sea-urchins ; but in the geuns *Diadema*, which is very common throughout the tropics, we found most curiously composed eyes, somewhat similar to those of insects. As light blue spots they run round the surface of the black sea-urchin, like the above described blue corpuscles of the leather-urchin. Each of these blue spots consists of many hundred small crystal cones, which rest upon a layer of nervous substance. Microscopical examination had already shown that the blue spots were eyes, and the simplest physiological experiment confirmed it. If the hand is brought near the aquarium which contains the sea-urchin, without touching the water of course, the urchin at once directs all its long spines against it to protect itself ; it sees therefore very well. Between the spines of *Diadema* a little fish lives, which

is protected in this case by the length of the spines, while the above-mentioned one found protection in the poison-apparatus of its host.

During the last days of our residence in Trincomalee, a sea-urchin was brought to us, which both by its size and by the splendour of its colours quite surprised us. It was a foot in diameter exclusive of the spines, which were two to three inches long. Its height was about six inches; on the ventral surface were shorter and stronger spines than above. Its colour was brownish black, and over it ran from the apex downwards broad Saturn-red bands, which in the whole of their length were dotted with very large splendid azure spots; these spots we discovered to be eyes, as in the case of *Diadema*. This gigantic sea-urchin has up to the present no rival, as far as we can learn from the literature on the subject. Probably it was brought up from a great depth to the shore by the strong current of the north-east monsoon. Should it prove, after a more exact systematical examination, to be a new species of the genus *Diadema*, we would propose to give it the name of *Diadema imperator*.

A BRIEF SKETCH OF THE MEDICAL HISTORY OF CEYLON.

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(Read Nov. 18, 1886.)

Introduction.

As I am to deal with a subject which is somewhat special, it is my natural desire, in expectation of meeting a mixed assembly, that my treatment of the contents of this Paper should be such as to prove interesting and instructive to non-professional as well as professional persons. To the professional part of my audience, the medical annals of this Island cannot but be replete with interest; and I trust that my other hearers will derive some useful information from an attempt to give an account of diseases which have prevailed in this country from the earliest period of which we have any record, the progress made by European medicine, and of the improvement in the sanitary condition of this Island effected during the present century.

Although the inhabitants of this beautiful Island have had a fair share of the "ills that flesh is heir to," it is satisfactory to know that the efforts which have been made by the officers of the Medical Service of this Colony, under the direction of an enlightened and beneficent Government, and by local self-governing bodies, for the improvement of the health of the people, have, through the blessing of a merciful Providence, been crowned with a great measure of success.

It is not my purpose to give you statistical details: these might add greatly to the value of the information contained in this Paper, but would detract from its interest. I shall merely give a statement of facts: and in taking a rapid glance at our past medical history, I will, in the first place,

touch on the salient points connected with the native or Buddhist system of medicine; next, on the medical history of the Portuguese and Dutch periods, so far as learned from records at my command; and lastly, on the great sanitary reforms effected since the British occupation of the Island.

There is a mine of rich material worthy of exploration in the archives of the Civil Medical Department, dating from its separation from the Military Service in 1858; but I have been able only to make use of published records and of the Administration Reports and Sessional Papers of the Legislative Council from 1864, the period at which their publication commenced.

Siṇhalese System of Medicine.

In the early part of the third century B.C., Aṣóka was the great Buddhist sovereign of India. He propagated the new doctrines of Buddha by erecting columns or pillars, on which were engraved those memorials or edicts he was desirous of making generally known. These inscriptions are remarkable monuments of the sagacity and benevolence of that great sovereign, who erected viháras, monasteries, and hospitals, thus giving effect to whatever there is of beneficence in Buddhism.

From an early period, the priests charged themselves with the duty of educating children and relieving the sick. It was in Ceylon that the Buddhist doctrines were first reduced to writing. These doctrines addressed to mankind in general, besides inculcating the duty of reverence to parents, love to neighbours, charity and other moral precepts, recommended the prosperous and wealthy to found Refuges for the blind, the destitute, the crippled, the sick and wounded both of man and beast. This was taught to be the surest method of attaining to the highest degree of perfection and holiness on earth, by means of which the future reward of the Buddhist faith might be obtained, viz., *Nirváṇa*, or an easy departure and utter annihilation. These motives actuate some of

the Buddhists to this day, and I have learned from reliable authority that the Buddhist contractor of the Planters' and Anthonisz Wards (Mahámarakkala Kurukulasúriyapaṭa-bendigé Solomon Perera) has actually built these hospitals simply at the cost price of the materials, in the hope of obtaining merit here and *Nirváṇa* hereafter. King Aṣóka also recognised the sanctity which attaches to human life, and directed that the life of no living being was to be taken; and that wells were to be dug, trees planted, and *caravansaries* erected in public highways for travellers.

The medical houses, or hospitals, of that period, were to be provided with all sorts of instruments and medicines, consisting of mineral and vegetable drugs, and food; and skilful physicians were appointed to administer them at the expense of the State. Those physicians, or *Vedarálas*, who had gained a knowledge of Sanskrit, committed to memory stanzas, and recited them by the bedside of the patient. These stanzas were from the *A'yur-Veda*, a religious treatise on the science of life and medicine.

The *A'yur-Veda* (from *âyur*, period of living, and *ved*, to know, treating of the science of life and medicine) is said to have been first preserved by oral tradition in the form of hymns, prayers, and precepts. It is regarded as the most ancient and authentic book on Oriental medicine, next to our own Bible, and consists of one hundred lectures, of a thousand stanzas each, called *ṣlokas*.

Fragments only of the manuscripts are now extant. It was supposed to have been composed by Brahma, 900 B.C., and handed down to the Buddhists by the Brahmins. It was intended to teach the proper manner of preserving life, and the means of preventing and curing diseases. Dr. Wise, the author of the "History of Medicine among the Asiatics," says that it contained a description of the structure of the human body prepared from actual dissection, an account of the causes and diseases to which it is subject, the enumeration of many useful remedies, and precepts for preserving

health and curing diseases. The works studied by our *Vedarálas* in Ceylon now, are the *Ṣastris*, *Charaké*, and *Suṣruta*, which are commentaries on the *A'yur-Veda*. The first is arranged in the form of a dialogue or conversations between *Atrya*, the master, and his pupils in their conferences. Sir Whitelaw Ainslie gives a list of twenty-one Sanskrit medical works, known in the early part of this century among the Siṇhalese and Tamil. There are no doubt several very intelligent and trustworthy *Vedarálas*, who are Sanskrit scholars, and study manuscripts on "olas," or leaves; but there are also a larger number of ignorant impostors in the villages, to whom the words of Job are applicable: "But ye are forgers of lies; ye are all physicians of no value!"

The Tamil books of medicine derived from the same source are published in the Tamil and other Dravidian languages. The Tamil practitioners are styled *Vayittiyan* and *Parikári*. The *Vayittiyan* of the Tamil people is largely engaged in treating infantile ailments, and many of them even confine their practice to children only of all classes, Muhammadans as well as Hindús. Those who take an interest in the Oriental system of medicine, and wish to pursue the study of the ancient Hindú, Buddhist, Arabian, and Chinese systems of medicine, will find a full account in Wise's "History of Medicine," published in 1867. The Moors or Muhammadans of Ceylon have their own native practitioners, who blend the Arabic with the Hindú systems of medicine. The recognised physician is called *Hakim*.

There were many kings of Ceylon who built hospitals and practised medicine themselves, and by their noble example made it an honourable profession. According to the *Mahá-waṇsa*, Buddha Dása, who reigned for twenty-nine years, from 339 A.D., was the author of a medical work called the *Sárártha Saṇgrahaya*. Many wonderful cures are attributed to him. He built hospitals for every ten villages, and placed medical men in charge of them. They were to receive one-fortieth of the revenue derived from fields for their

maintenance. He also appointed medical men to attend on his infantry, and veterinary surgeons to attend on cattle and elephants. Along the roads he built halls for the lame and blind. It is said that "When he went out of the palace, his surgical instruments were always in his waist, and he operated upon all sick persons whom he met." King Agbo, who reigned six years, from 782 A.D., caused medicines to be distributed among the sick; and Dappula II., who commenced his reign in 795 A.D., is most highly spoken of in this respect, in the following words : "That most gracious Prince built a hospital at Polonnaruwa. He also in like manner built a hospital at Pandaviya, and endowed it with villages which yielded the necessaries of life. He also built in several places halls for the cripples and the blind. In short, he did not leave anything undone which was called meritorious ; he even gave growing paddy crops to cattle, and rice, mixed with honey and sugar, to children."

Parákrama Báhu, who reigned from 1163 to 1196 A.D., built a large hospital capable of accommodating hundreds of patients, and appointed a manservant and maidservant to attend on each patient for the purpose of supplying him or her with necessaries of life and medicine. He ordered medicines and the necessaries of life to be made and stored in the hospital, and appointed skilful and salaried medical men to attend on the patients. Divested of his royal robes, he visited the hospital four times a month, and inquired into the nature of the disease of each patient, and the mode of treatment adopted ; and whenever the treatment was in his opinion erroneous, he taught the physicians the proper method, and attended himself to some cases.

When the patients recovered, he distributed clothes amongst them. This prince is said to have cured a crow of a tumor, and the bird, it is stated, would not leave the hospital until attended to ! Nor was sanitation ignored. King Pandukábhayo, who reigned 437 B.C., employed one hundred and fifty men to carry dead bodies to the cemetery, and one hun-

dred and fifty men as cemetery-keepers and sextons, besides two hundred night-soil men, a small number of day and night guards, and a small army of sweepers.

Portuguese Period.

In the history written by a Portuguese author, Juan Ribeyro, in 1685, there is only a very brief description given of the diseases which prevailed in Ceylon at that period, and I can find no allusion to the methods of treatment adopted by medical men of his own nation. The Portuguese priests and captains of companies appear to have been in medical charge of the garrisons of Colombo, Kalutara, Negombo, Batticaloa, Trincomalee, Jaffna, and Mannár.* Ribeyro states that most of the Portuguese on their first arrival were subject to bowel complaints, fevers, and other diseases, to which the natives are not liable. He thought that the Sinhalese retained their health by frequent baths, and states that when he first came out to Ceylon he had two illnesses in the first two years. He then adopted the native habit of bathing twice daily, and during the sixteen subsequent years he lived here he never became ill. Frequent bathing is acknowledged to be one of the best means of preserving health, and is practised by the natives to this day; but it is in strange contradiction to the experience of an old colonist of 70 years, an Italian, now dead, who attributed his immunity from disease to his *never* bathing!

Ribeyro describes "beri-beri" *(bére-bére)* as a disease to which Europeans were very liable. He recommended as the best remedy pork and biscuit, with palm wine (toddy) and smoking, to be persevered in for three months. As a

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* A correspondent points out that Le Grand has not followed Ribeyro accurately here. "It is not strictly correct to say that the Portuguese priests and captains of companies appear to have been in medical charge of the garrisons of Colombo, &c. Ribeyro (Bk. I., chap. xiii) distinctly says that when the soldiers were seriously ill they were sent to the hospital at Colombo, and that the surgeon had to certify the necessity of this: Le Grand omits this statement."—*Hon. Sec.*

prophylactic against this disease, the Captain General Antonio de Mascarenho issued an order for every one in the camp to smoke.

Ribeyro only briefly alludes to "Paraṇgi" disease *(Paraṇgi leḍa)*, that unsightly and disfiguring skin disease which prevails to this day in the districts of Mullaittívu, Vavuṇiya-Viláṇkulam, Anurádhapura, and Kurunégala. He called it the "Neapolitan disease," named by the natives "*Paranguelere*," or "Portuguese sickness," since the Portuguese first introduced it into this country; and he says it "is not easily cured."* Fever is only mentioned, to be dismissed with its remedy, viz.:—a decoction called *coantru.*† Those who know Portuguese are aware that the remedy is a common and useful one, employed to this day. Coriander seeds boiled down with ginger into a decoction is commonly used in the cold stage of ague, and in catarrhs and colds in the head. Ribeyro states, as we can bear testimony even now, that no people understand the use of simples better than the Siṇhalese, so that with a few herbs or roots they cure wounds, ulcers, and swellings; but it is extravagantly stated that they set broken arms and fractured legs, and put those matters to right in a very few days. He also noted the good effects of herbs as antidotes against the bites of snakes and venomous insects. We must admit that many *Vedarálas* are good bone-setters, although they have no proper appliances for preventing shortening of broken limbs. Their method of stuffing a wound and keeping it dilated, when it is connected with a compound fracture (although aromatic, antiseptic, and astringent herbs are used to check bleeding and prevent putrefaction) cannot be approved except as a temporary measure, until proper surgical aid is obtainable. The historian

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* The writer quotes Lee's translation of Ribeyro, which is merely Le Grand's version Englished. Ribeyro's actual words are :—"As *mal gallico* chamao *Parángue rere*," &c.—*Hon. Sec.*

† Ribeyro, "*coentro.*"

must have been deluded, when he was induced to believe that cancers, which are considered incurable in Europe, were cured in a week in Ceylon. Ribe yro also alludes to the prevalence of small-pox, which t he natives called "*ankaria*, or an affair with God," because it appears as if only a miracle can cure it.*

The following sketch of the mission of Padre Vaz, a Portuguese Priest in Ceylon, who died in 1711, is taken from a Portuguese work written by Padre Dorego :—"The small-pox now visited Ceylon, and made fearful ravages. The people believing that all persons labouring under the disorder were possessed by the devil avoided them, as they would him ; the father ran away fro m his children, the wife from her husband, leaving them to perish without food : the sick perished, therefore, as much from hunger and panic as from the virulence of the disorder. The dead became so numerous that they were left unburied, or carried to distant places, while the poor wretches affected were driven by the Government into the jungle. When the contagion had reached Kandy, the king left it, as the stench of the dead bodies in the streets was unbearable. *Vaz* resolved to visit both Christians and Pagans, and being with provisions from his followers in Colombo, relieved their distress. He also followed the sick into the jungles, and building huts as well as time and place would permit, there sheltered them from the elements and the attacks of wild beasts : in a word, he contrived to supply every want, temporal and spiritual, performed the most menial services, opened hospitals in the deserted houses, and dared everything for their relief. The result was that members who were saved joined the Church,

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* The same correspondent writes :—"This is Le Grand's statement. Lee in his translation of Le Grand did not attempt any explanation of this wonderful word *Ankaria :* what Ribeyro really wrote was *Deanécharíya*, *i. e.*, *Deviyankāriya*. Le Grand apparently mistook the first syllable for the proposition *de !* (I may mention that I possess the MS. of Ribeyro's narrative used by Le Grand, and that it reads *deancharia ;* in this MS. the words are run together very much, so that there was some excuse for this blunder.)"—*Hon. Sec.*

and had their children baptized. Ribeyro's editor, Le Grand, speaks of the habit of betel chewing among the natives, Portuguese and Dutch; he thinks it a wholesome practice, which purifies the breath, strengthens the gums, and cleanses the bowels. The Sinhalese at that time attributed their long and healthy lives to its use, and Ribeyro confirms it by saying that men and women were seen in Ceylon who had not lost a single tooth. We unfortunately know that the practice of betel chewing presents another side; it produces "betel-chewers' cancer."

Dutch Period.

The Leper Asylum at Hendala is perhaps the only monument of the medical history of Ceylon during the Dutch period which is left to us. There is no authentic record of its foundation beyond an inscription on a stone, "Anno 1708," and a monogram scarcely decipherable, indicative perhaps of date of building and of the original owner of the property on which the institution stands. It is generally believed, on traditional authority, that it owes its origin to a philanthropic Dutch lady, daughter of a Dutch Governor, who was herself a leper, and at her death left the property to Government, in trust for the pauper lepers of the Colony.

In a memorandum made by Governor Van Imhoff in 1740, he commends this institution to the care of his successor. Although frequent search has been made among the archives of the Government Record Office for documents or information relating to the transfer, nothing has come to light to show how the Government became possessed of a property sixteen acres in extent, occupying one of the most beautiful sites in the neighbourhood of Colombo, at the mouth of the Kelani river, admirably adapted from its situation, isolation, and distance from town for the segregation and treatment of lepers. This hospital was certainly the first in the Colony founded by private benevolence, and supplemented only of recent years by the foundation of other charitable institu-

tions, especially at the hands of the De Soysa family. In this Asylum, which has separate wards for lepers, and paupers suffering from incurable diseases, one hundred and forty-four remained at the end of 1885 and sixty-five were admitted during the year 1886, making the total number treated two hundred and nine : one hundred and ninety-seven lepers and twelve paupers. The patients treated in this institution, one hundred and seventy-six at present, are well cared for, and all that science and humanity can suggest is adopted for their comfort and happiness. The new wards are the finest of any in the Island, well built and well ventilated.

There is no certain information available with regard to the state of medical practice in this Island during the Dutch period, extending from 1656 to 1795. It is reasonable to suppose that there were army surgeons among the Dutch, as under the British, and that some of these were probably regularly qualified men from the colleges of Amsterdam, Utretcht, and Leyden,—with the latter of which the name of the great Boerhaave will ever be connected. There may have also been one or two civil practitioners, and these may have been assisted by young men of the country, who helped them behind the counter, and picked up a knowledge of medicines and their application. Among the hospital dressers and dispensers of that day, there were many who attained a certain eminence, whose names are yet recalled by old residents, who can remember them "with a touch of affectionate pride." In those days the apprentice system was in vogue, and if there was no opportunity of walking the hospitals, there was, at least, for mixing and triturating drugs. Medical skill was empiricism, and although Stahl, Boerhaave, and Hoffman, with the ancient medical classics, might have been studied by a few old Dutch doctors who came to Ceylon, the probability is, that like the early British army surgeons, the Dutch doctors who came here were not university men. However, from the large number of those who took service under the British at the cession of the Island in 1795, it is evident that medical

science had made some considerable progress in the Island, and that many native and Dutch descendants had applied themselves to its study.

Dutch physicians have been noted for their knowledge of botany, and the extensive field afforded in Ceylon for its study was an especialat traction. The flora of the Island was arranged and described by Linnæus, with the aid of the celebrated herbaria collected by Herman and Hartog, both of whom were sent out to Ceylon by the Dutch East India Company, in 1671. It is also interesting to note that the first European writer on tropical diseases was a Dutchman named Bontius.*

There are no records extant to show that any effort was made by the Dutch to teach the science of medicine systematically to the natives, but it appears that the kings of Kandy often requested through the Government the medical aid of Dutch doctors, which the Dutch Governor of Colombo complied with.

The mission of Doctor Danielsz and his apprentice to the court of Kandy in 1739, to cure the King Ṣrí Vijaya Rája-siṇha of a bad leg, as recounted in his journal, is replete with interest. The late Doctor Koch, in his introductory lecture delivered at the opening of the session of the Medical School in 1872, thus recounts the particulars of that memorable visit: "Doctor Danielsz went accompanied by his apprentice; but all he could see of his royal patient was the ailing limb. Under such circumstances it was impossible he could adopt any other course of treatment but what consisted of outward dressings. These he tried without any satisfactory results, and alarmed

* The same correspondent notes here:—"So far as I know, Dr. Vanderstraaten is correct in stating that Bontius was the first European writer on tropical diseases; but there was another medical writer on the subject, who followed not so long after, and whose work passed through several editions. I refer to Dr. Ægidius Daalmans, a native of Antwerp, who went to the East in the service of the Dutch in 1687, visiting Ceylon, Java, and India, and returning to his native land in 1689. Dr. Daalmans' book is very rare, the British Museum not possessing a copy."—*Hon. Sec.*

at the consequences of failure, he insisted on His Majesty taking a course of tonics. The decoction was prepared, but the king found it so bitter that he emptied the cup into the royal spittoon, suggesting that the doctor should employ the more agreeable article of arrack for the conveying of the nauseous potion. Doctor Danielsz hereupon brewed two bottles of bitters, but he prescribed so small a dose of it at a time (he calls it a small beer-glass full) that His Majesty demanded either a double dose or to be allowed extra liquor over the bitters; after a good deal of resistance the doctor was at last compelled to yield, and as he said he was himself in the habit of taking a *schnap* before meals, his patient also might, but positively not beyond the third day. In the meantime the leg was not improving, and the *régimen* was becoming intolerable, and so Doctor Danielsz was bid prepare to leave Kandy; and, if he could not congratulate himself on his professional success, we may yet suppose he was glad enough to escape the attentions of his patient, which now began to assume a form slightly more imperative than was altogether pleasant. So Doctor Danielsz and his apprentice returned to Colombo, and continued no doubt to adorn the profession till the natural close of his not uneventful life."

British Period.

Mr. Henry Marshall, Surgeon to the Forces, who served here from 1808 to 1821, has left us a valuable work on the "Medical Topography of Ceylon, and on the Health of the Troops employed in the Kandyan Provinces from 1815 to 1820, with brief remarks on the prevailing Diseases." From this work I have gathered some interesting passages. The troops employed during the early British occupation consisted of Europeans, Caffirs, Malays, and natives of India. Marshall says that the individuals of each class preserve a strong physical and moral resemblance, using the same food, having similar wants, undergoing the same labour, and suffering the same privations. Each class had particular

prevailing diseases, according to the effect of the climate, exposure to malarious influences, and variations in their food-supply. The Europeans suffered from the endemic intermittent and remittent fevers, abscess of the liver, and dysentery, but they were greatly exempted from many diseases to which they are liable in their own country. A large number of British soldiers suffered from the effects of intemperance added to the effects of the climate, and no wonder when arrack was then retailed at sixpence a quart! It was Marshall's opinion that the regular issue of spirit rations engendered the desire for the immoderate use of spirits, and that frequent indulgence created a craving which had to be supplied. The same sad tale of spirit drinking, as one of the principal causes of sickness and mortality among the troops in Ceylon, is repeated in the Military Sanitary Report for 1864. Five per cent. of the troops were then reported to be confirmed drunkards.

Africans, called at that time "Kaffries," and who composed five companies of the 2nd Ceylon regiment, the remains of two other regiments 3rd and 4th, were chiefly recruits procured on the east coast of Africa, in the neighbourhood of Mozambique. A few of them were evidently children of Africans brought here by the Dutch. They made good soldiers, and were remarkable for longevity. They were habitually temperate; but the Malay recruits from Java and Sumatra, for the Ceylon regiments, were addicted to the use of bhang and opium. Although the immoderate use of these narcotics was nearly as hurtful as the free indulgence in spirits, the excessive opium eaters among the Malays were less numerous than the immoderate drinkers among the European troops. They were liable to intermittent fevers or ague when exposed to malaria in the jungle; inflammation of the lungs, consumption, asthma, and pocky-itch, so called by Mr. Marshall from the eruption leaving deep marks on the skin. The Indian troops, who formed the corps of Gun Lascars, the Pioneer Corps, and five companies of the 2nd Ceylon

regiment, came from the Madras Presidency. They were a useful addition to the garrison, and were capable of much exertion when kindly treated. They were sober, temperate, and submissive, but extremely filthy, and owing to their neglecting to provide against sudden changes of temperature, were more liable to intermittent fever, inflammation of the lungs, dysentery, and diarrhœa; Malabar itch was, as may be expected, very common among them.

Distress was caused in 1812, 1813, and 1814 by repeated droughts resulting in failing of the crops of rice. It was deplorable, says Bertolacci, to see the numerous children of the Ceylonese families reduced and emaciated for want of food, and depending upon parents who were in no way able to provide for their large families. No substitute could be found for the staple article of diet for the native troops, and consequently privation and exposure led to much suffering. At Minery, between Kandy and Trincomalee, fifty-three men of the 19th regiment were attacked with fever, thirty-three died, and twenty recovered; but several of them had their constitutions much impaired. Of thirty-three artillery men, eleven died.

In December, 1820, there were thirty-two military stations in the interior, the chief posts being Kandy, Badulla, Aliput (fifteen miles east of Badulla), Ratnapura, Fort King and Kuruṇ̣egala, all of which were hospital stations. The Rev. Mr. Cordiner records that a small outpost in 1803, Koṭṭadeṇiya (thirteen miles from Kuruṇ̣egala), was so unhealthy that of seventy men of the 65th regiment who marched to it, every one was seized with fever, and within a month Lieutenant Hutchings and two privates were the only persons of the party who remained alive.

It will be interesting, before proceeding further, to glance at the nature and extent to which the principal diseases which existed in Ceylon prevailed in the earlier years of the present century, soon after the British settlement in this Colony. Davy considered the effects of the climate of Ceylon

under three heads : "First, those which occur immediately; second, those which are produced slowly and gradually; third, those which arise occasionally and unexpectedly from the agency of peculiar causes. As to the immediate effects which result from the transition of the body from a temperate climate into a tropical one, we have ample evidence derived from the accounts of voyagers; such as disagreeable sensation of heat, acceleration of the heart's action, increased perspiration, langour, restlessness, and thirst, diminished appetite and general indisposition"; but these do not constitute actual disease, nor do they necessitate active medical treatment. "Europeans landing in Ceylon are liable to few ailments due to immediate causes." Prickly heat (*lichen tropicus*) is perhaps the most common. "During the wet seasons," says Percival, "the Ceylonese are subject to a variety of diseases. Every man is here his own physician, and the mode of cure adopted is of course very simple. A plaister of herbs is applied to the part affected, and I have seen the same remedy applied to a man in a high fever, when his whole body was daubed over with this ointment. A skill in medical herbs is almost universal among this race, and they have a variety of prescriptions for curing diseases by their application. This knowledge is owing to their peculiar fondness for gardening, rearing all sorts of plants, an employment in which they are engaged from their infancy, and it is from among them that the European gentlemen are anxious to procure their gardeners."

Small-pox seems to have been, as it still is now, the most dreaded disease. It has doubtless been the one great cause of the depopulation of the Island, and Forbes thinks it was this visitation which was described as the "red-eyed demon of pestilence" that swept the country of half its people in the third century, under the reign of Ṣrí Sangabo. It is called *mahá ledda*, or "the great sickness," and is believed to be "a direct infliction of the gods." Percival states that persons dying of this disease were considered

accursed, and that, viewed as a means of God's vengeance, no attempt is made by incantations and exorcisms, as is done in other diseases, to propitiate the gods. Even the rites of burial are denied, the body of the dead being removed to a distant jungle, and then left covered with bushes and branches of trees to decompose. The goddess *Pattini* is believed to have the peculiar power of averting or preventing small-pox, and to her is dedicated a temple situated in the forests on the side of Ambokkekanda, where also stands the remains of Raṇgula Nuwara.* Pridham relates that during the prevalence of small-pox at Mátalé, the *Kapurála*, or lay priest, of Ambokké, was in constant request, and reaped an abundant harvest from the terror and superstitions of his neighbours. Every village in the vicinity of an infected place, by means of presents nominally offered to the goddess, but the most valuable of which were appropriated by the *Kapurála*, procured his presence; and the relics from the temple, consisting of a shield and bangle (amulet), were borne through the village followed by all the inhabitants, and duly honoured by the noise of every tom-tom, pipe, shank, shell, or trumpet which they could procure. The *Kapurála* had been at a former period afflicted with the natural small-pox, and was shrewd enough to have his whole family vaccinated, though his supposed temerity in visiting infected villages, and his good fortune in escaping contagion, were accounted for by himself, and believed by the people, to arise from the protection of the goddess. His influence was hence considerable, and his selfishness led him to use every secret means of checking the progress of vaccination among the dupes, by whom he was enriching himself.

Active measures in the prosecution of vaccination, the introduction of legislative measures to help on this good work, and to enable those in authority in the exercise of a wise discretion to isolate and effectually segregate the

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* See R. A. S. Journal, No. 29, 1884, pp. 368–394.

infected, have diminished the horrors of epidemics of this disease, and in the present day a scene like the following, as described by Forbes, cannot be expected to occur: "I found," he says, "lying in a field, with her head close to a well, the body of a woman who had but lately expired. Tormented by thirst and deserted by her friends, she had crept to the water, whilst in the last agonies of this loathsome disease. By permission of her relatives I offered her property, including a portion of land, to whoever would bury the body, but all my arguments and entreaties would not induce anyone, even the most wretched pauper, to acquire a competency by burying it."

Cholera, as an epidemic disease, has at different times made fearful havoc in the Island. Marshal states that epidemic cholera having prevailed in 1817 in India, broke out at Jaffna and Maṇṇár in 1818. It subsequently appeared in Kandy, Colombo, and other garrison towns, a few only of the smaller outposts in Sabaragamuwa, &c., escaping the infection. One of the earlier outbreaks occurred in 1832, at Trincomalee, when it decimated the detachment of the 78th Highlanders at that time stationed there. A very eminent medical man, who had examined the military building at Trincomalee at this time, gave the late gallant Admiral Sir John Gore, his opinion in the following emphatic words:—"The position and construction of the barracks are admirably adapted for originating, and the hospital for maintaining, disease." Subsequent and later epidemics will receive notice under their respective years of occurrence.

Berry-berry, *beri-beri*, or *bere-bere*, prevailed in Ceylon during the earlier part of the present century. It receives notice from Percival (in 1803), who states that it was occasioned by "the low diet and bad water which the natives are accustomed to use, and in part, perhaps, by the dampness of the climate in the wet season. It swells the body and legs of the patient, and generally carries him off in twenty hours." In his time the plan of treatment was to rub the

patient over with cow-dung, oil, chunam, lime juice, and other preparations from herbs, and then bury him up to the chin in hot sand.

I shall now attempt a cursory notice of the principal events in the medical history of Ceylon, gathered from official documents.

Vaccination was introduced into Ceylon as early as 1802. According to Bertolacci, who wrote in 1817, the population of Ceylon eight or ten years prior to that date was calculated at 700,000. The number vaccinated between 1802 and 1812 was 221,082, and it is stated that the efforts of the British Government to eradicate small-pox by means of vaccination were so successful that for eleven years the disease did not occur in Ceylon. The low-country Siṇhalese, when they found by experience the protective benefits of vaccination, crowded into the British settlements for the purpose. The Kandyans, or natives of the hill country, who had been at enmity with the Portuguese, Dutch, and British, still kept aloof from communication with the Maritime districts; but, though they did not acquire the direct benefits of vaccination, they were free from the disease when it had been eradicated by the prophylactic in the low country. They used to drive their small-pox patients into the jungles of the low country.

In 1803, Mr. Percival, an officer of the 19th regiment, suggested that vaccination should be made compulsory (sixty years afterwards, in 1863, it was made compulsory by Sir Charles McCarthy); in 1837, Dr. Kinnis, of the Army Medical Department, wrote a long letter to the inhabitants of Ceylon on the advantages of vaccination. It was translated into Siṇhalese, and must have done much good in making the benefits of vaccination generally known.

The first mention of the Lunatic Asylum occurs in the speech of Sir James Stewart Mackenzie, delivered before the Legislative Council in 1839. Up to that time insane persons had no special hospital provided for them, the common jails, and for a period, the Leper Asylum at Hendala, being

used for their safe custody. In "earnestly pressing for adoption," the draft of "An Ordinance to establish Lunatic Asylums," His Excellency said that "the cases of distress and misery from time to time brought to the notice of Government, prove beyond a doubt that the time has arrived when it has become imperative for the protection of those unfortunate persons, and, in some cases also, for their maintenance and support." Not long afterwards, under the *régime* of the same Governor, arrangements were completed "for the purpose of receiving those unhappy lunatics, who," to use Sir Stewart Mackenzie's own words, "are rather numerous, and from various parts of the Island are now boarded, lodged, fed, and taken charge of at a much larger expense than if they were under one superintendent for the males, and another for the females, in buildings contiguous to each other. All this is now done in a most unsatisfactory manner in respect to health, cleanliness, and every requisite for such an establishment."

The cost of converting the small-pox hospital at Borella into a lunatic asylum was estimated at £2,000, and this alteration was ultimately carried out satisfactorily. Since then this building, which was added to and enlarged from time to time, served the purpose until growing needs and advance in sanitary science, led to the adoption of a fresh site and improved architectural plans for the present new asylum situated at Jáwatta. There are now 353 patients in the old and new asylums. On the opening of the Borella Asylum, in 1847, the Government placed the institution under the medical care of a specialist, Dr. Davy, who was sent out from England. The appointment, however, on being subsequently vacated by him, passed into the Medical Department, Mr. Ebert being appointed to the post in 1849. Under the care and supervision of successive officers of the Civil Medical Department, everything possible was done that could conduce to the comfort and well-being of the unfortunate inmates.

The administration of Sir Stewart Mackenzie, and the year

1839, was further marked in medical annals by the first mention in His Excellency's speech to Council of a Medical School for Ceylon, and of certain measures to be adopted by Government, which afterwards contributed in a very great measure to the efficiency of the Civil Medical Department.

His Excellency then said :—"The evident inadequacy of the former rates of salaries, to ensure the services of persons duly qualified in point of professional attainments and general respectability, left no doubt in my mind of the necessity of increasing the remuneration of the native medical establishment; and while a higher scale of salaries was introduced, steps were taken to ensure to the junior members a regular course of instruction, both by the Military Medical Officers serving in the Colony and at the Colombo Academy. I also took advantage of the means of education Calcutta afforded to medical students, by sending certain more advanced youths to be educated there at the expense of this Government, with a view to employment in the Colony on their return. The Home Government has directed me to submit to you these arrangements, involving as they do an annual expenditure of about £3,500. It is for you, gentlemen, to declare whether this Colony does not stand in need of an efficient class of medical practitioners." His Excellency, in alluding to the necessity of a School of Medicine, added that he hoped the time was not far distant, when he should be able to propose to his Council, in furtherance of his views for the improvement of the class of medical men in the Department, the establishment of an Anatomical School; and it was even suggested that certain alterations might be effected in the late Pettah Hospital (at present the head-quarters of the Ceylon Light-Infantry Volunteers) for this purpose; or failing this, that Her Majesty's Government would sanction "there being attached to the Colombo Academy such a system of medical education as will provide the means of adequate instruction in the medical profession in future for the Colonists, without their leaving their native

Island." Sir Stewart Mackenzie predicted what has been fulfilled. "I need scarcely add," he said, "that if these measures are successful, they will become the means of opening to the inhabitants of the Colony a new and most useful branch of professional employment."

Very few are now alive, who, under the designation of "Medical Sub-Assistants," served under Military Medical Officers, heads of the old Department. One of the earliest lists of the officers of the Civil Medical Department which I have been able to find is that for 1817. Between this date and 1858, when the Civil Medical Department became a distinct establishment, a large number of individuals, natives of the country, were educated and trained under Military Medical Officers. Many of these Military heads of the department appear to have been as kind-hearted as they were eminent for their scientific attainments, and the members of the subordinate department who still survive speak with a respect and affection of Forbes, Stewart, Barclay, Kinnis, Rowe, Ferguson, Templeton, Cameron, Fleming, and others, who, while ruling the department wisely and well, took a personal interest in the welfare of their subordinates.

Dr. Kevett, in 1835, was the first who attempted to organise a medical class. His pupils were the late Mr. Ferdinands of Kandy, E. F. Kelaart, P. H. Van Cuylenburg, M. B. Misso, Trask, Cleveland, and Ebert of our service. Of this number, Kelaart having obtained the opportunity of a free passage to England, as surgeon's assistant, accompanied the 78th Highlanders, and returned with a Commission as Staff Assistant Surgeon in 1840. Dr. Kelaart may, therefore, be considered as the first Ceylonese who acquired a British Medical degree; and his career as a physician and a naturalist was distinguished. His work "Prodromus Faunæ Zeylanicæ" is a monument of his talent and industry.

The slight attempt at imparting medical knowledge which I alluded to, was shortly after followed by a regular class for

the systematic teaching of the science of medicine under Staff Assistant Surgeons Templeton and Cameron, under the supervision of Dr. Arthur Stewart. The lectures delivered were mere explanations of the contents of text-books. This plan of educating medical officers was but partially successful.

The clinical teaching at the Military Hospital, Colombo, not being found to answer as fully as desired, the Government determined to send students to Calcutta for their medical education. It was not until the beginning of 1843 that graduates of the Bengal College joined this service, and among them may be specially mentioned the names of Drs. Anthonisz, Loos, Dickman, Kriekenbeek, Ondatjee, Andree, Wambeck, Markus, Margenout, and Breechman, who have all, either by death or retirement, now severed their connection with a department they served honourably and usefully, the first two having had the distinguished privilege, upon more than one occasion, of administering the Medical Department, during the temporary absence of its head from the Island. Speaking of his predecessors, Dr. Koch, himself a graduate of Calcutta, says in his lecture: "Nothing conduced more to familiarise English practice amongst the natives of the Island than the services of these young men on their return. They undertook and performed with success the most formidable surgical operations, and the name of Dr. Anthonisz will always be connected with the first successful cases of æsophagotomy and ovariotomy in Ceylon. Indeed, if I am not mistaken, the first-mentioned operation was the first successful one of its kind ever recorded in the whole annals of British surgery."

Dr. Ondaatje was Acting Superintendent of the Royal Botanical Gardens at Péràdeniya in 1843–44, before the appointment of Dr. Gardener, and he has since given proof of his intimate knowledge of the productions of the country, and their economic uses, in his contributions to the Journal of the Asiatic and other societies.

Much attention was devoted in 1852, during the administration of Sir George Anderson, to the operation of the quarantine laws, and the improvement of the drainage system of the capital. That pestilential ditch in the Pettah, misnamed "St. John's River," was entirely covered in, several new streets were opened, drainage on an extensive scale was planned, both by the opening out of new drains and the widening of old ones; indeed, at no great cost, much was done to increase the salubrity of the town and the comfort of its inhabitants.

Various sums were from time to time voted by the Government of Sir Henry Ward for the improvements of Civil Hospitals. The state of the Pettah Hospital, then the General Hospital of Colombo, was not creditable to the Colony, and a sum of £3,000 was voted for the purchase of a better site in the suburbs. It was after this that the present General Hospital was built, and opened in 1864.

In 1857 a Select Committee was appointed by the Legislative Council to report upon the Fixed Establishments of the Colony, and one of the recommendations made was that the Civil Medical Department should be separated from the Military Medical Department, and placed under the control of a Civil Medical Officer, as the existing Civil Department was insufficient for the requirements of the Island, and the military heads of the department were shifted too often for opportunities to acquire local experience. A Civil Medical Establishment was proposed, consisting of a Principal Civil Medical Officer, two Colonial Surgeons, eight Assistant Colonial Surgeons, and twenty-eight Medical Assistants, all with salaries adapted to secure efficiency and ability. Dr. Elliott, eminent in Ceylon as a public man, and well-known for his ability and philanthrophy, was in England when the report was published, and he lost no time in applying to the Secretary of State for the Colonies for the new office of Principal Civil Medical Officer. He was appointed, but his tenure of office was unfortunately too short to enable

him to carry out several beneficent plans. He died, deeply regretted, on May 22, 1859.

In 1865 cholera broke out in a severe epidemic form at the pearl fishery, and rapidly spread to Trincomalee, Negombo, and Colombo. In the following year it occurred in all the principal jails, but with care and attention it did not spread, and there were but seventy-seven cases among prisoners, with thirty-one deaths. The visitation was of a sporadic character, until the close of that year, and then broke out severely in an epidemic form in the Northern Province. The whole of that Province was rapidly affected, but the disease established itself more particularly in the Peninsula of Jaffna; 9,092 cases occurred in the Northern Province, 8,696 of which were in the Peninsula of Jaffna, and 473 proved fatal. The disease was so much on the increase at the close of the year that His Excellency Sir Hercules Robinson appointed a Commission to visit Jaffna and report upon the causes which led to the outbreak of cholera in that peninsula. The Commissioners worked with much zeal and assiduity, conducted their inquiries on the spot, and after personal inspection of the localities which suffered most severely, and examination of the leading and well-informed persons of all classes of the community of Jaffna, drew up a voluminous and valuable report, which was laid before the Legislative Council. The report consists of the history of the epidemic, the modes of treatment adopted, the customs and habit of life of the people as bearing on the epidemic, recommendations for the sanitary improvements of the town and villages of Jaffna, and measures of precaution to be adopted against future outbreaks. In the Northern Province 10,064 cases occurred during 1867, of which 6,862 died. The remaining provinces suffered comparatively little, the total in these being only sixty-three cases, with forty-two deaths.

In 1867 Sir Hercules Robinson ordered an inquiry into the causes of the depopulation of the Vanni, and this investiga-

tion, on the recommendation of Dr. Charsley, was entrusted to Dr. Loos, then Colonial Surgeon of Jaffna. The conclusion he arrived at, after a careful inquiry, was that the depopulation was due to malarious fever and to the prevalence of an inveterate skin affection, possibly associated with an hereditary specific taint, aggravated by insanitary conditions, and known in that district as the "Paraṅgi-disease." His report on this subject is well worthy of perusal. The duty entrusted to him was performed in such an efficient manner that he received the special thanks of the Government; and his report was submitted to the Legislative Council, printed and circulated among the members of the department and others. In accordance with his suggestions, new hospitals at Mullaittívu, Anurádhapura, and Vavuṇiya-Viláṅkulam were established for the treatment of cases of this disease. It was, however, at the special desire of Sir William Gregory that more extended efforts were made during the year 1872 to afford medical aid to those suffering from Paraṅgi; and Dr. Danforth, a very efficient medical officer, educated under the American missionaries, was placed at Vavuṇia-Viláṅkulam to study the disease, and afford aid to sufferers. Dr. Kynsey wrote a very elaborate report embodying the observations and experience of all the medical officers who had opportunities of studying this disease. He had a series of drawings made illustrative of the disease in its various stages, and presented it, through Government, to the Royal College of Physicians, London. Dr. Kynsey's report is among the Sessional Papers of the Legislative Council, and is a complete history of this curious and loathsome disease.

In 1870 a milder epidemic of cholera prevailed in the Southern Province. It broke out at Kattragama during the Hindú festival there, and followed the track of the returning pilgrims.

Whenever cholera is prevalent on the south coast of India, it generally finds its way into the Island through the medium of the immigrant coolies, who land at Maṇṇár and

travel along the great Central-road to the Eastern Province. There are five immigrant hospitals along this road, where sanitary precautions are taken, and great attention paid to the comfort and health of the immigrant coolies on their long march from the coast to the coffee estates.

It was in 1869 that the new hospitals at Kandy, Gampola, Badulla, and Ratnapura were completed and occupied ; since then new hospitals have been erected in the towns of Galle, Mátara, Negombo, Mátalé, Kurunẹgala, Batticaloa, Puttaḷam, and Kalutara. These new hospitals have been constructed on the pavilion principle, each ward being a separate detached building, and the ventilation and drainage are satisfactory. The pretty little hospitals at Pánaduré and Márawila are gifts of the late Susew De Soysa, Mudaliyár, and the Lying-in-Home was built by Mr. C. H. De Soysa.

The year 1870 marked a new epoch in the medical history of Ceylon. To Sir Hercules Robinson belongs the credit of sanctioning the inauguration of the Medical School, which was raised to the dignity of a College in 1880, when the late Sir John Douglas, K.C.M.G., was Lieutenant-Governor.

Thanks to the liberality of one of our well-known public-spirited fellow townsmen, who granted a free site opposite to the Civil Hospital, this school now has a local habitation. Government voted a sum of R12,000 for the erection of a building on this site, which now contains lecture-rooms, library, anatomical, physiological, and chemical laboratories. Mr. Sampson Rajapakse's name has further been associated with this institution for the last thirteen years, as he is also an annual donor of a prize of R100 for the best student in Obstetric Medicine. The late Susew De Soysa, Mudaliyár, built the De Soysa Museum and Library, at a cost of R12,000

This College has been in existence for sixteen years and has prospered. Dr. Loos had the honour of being its first principal, and he vacated the office on his appointment as Colonial Surgeon of the Central Province in 1876, when

the late Dr. Koch succeeded him. The untimely death of this talented officer in December, 1877, from the effects of a dissecting wound, is still remembered, and the handsome memorial tower erected by public subscription, to hold a valuable and massive clock, granted by the Government of Sir James Longden, will remain a monument to his excellence and usefulness.

We have now fifty-nine licentiates on our register, twelve of whom have succeeded in obtaining British qualifications. A number of hospital assistants from the secondary class are also employed all over the country.

The reorganisation of the Civil Medical Department in 1873 testified to the desire of Government to place it on a more efficient footing, and make it more useful to the Colony. The Administration Report for the year 1873 was the last furnished to Government by the late Dr. Charsley, who retired in 1874, but did not live long to enjoy his well-earned pension; he died at the Cape in 1880. It is impossible to avoid adding a tribute to the able and conscientious manner in which he discharged the duties of the high office which he held in this Island for a period of fifteen years. Dr. Kynsey succeeded him, and took up his appointment as head of the Civil Medical Department at the end of March, 1875.

Mr. Joseph Fernando, of Moraṭuwa, erected a building at Béruwala, and the late Mr. Harmanis Dias one at Baṇḍára-gama, in Rayigam Korálé, for outdoor dispensaries. The friends of Dr. Anthonisz have given us two comfortable wards at the General Hospital. Of 156,693 patients treated last year in the forty-five outdoor dispensaries scattered over the Island, 13,010 were attended to at the Béruwala dispensary, which was the largest number treated at any place during 1885.

This concludes a hasty sketch of the principal medical events of the Island. We have reason to be grateful to a paternal Government for the deep interest it has always

taken in the health and well-being of the people, and for its efforts to remove and mitigate evils or causes of disease and mortality.

To the Legislative Council we are indebted for the liberal votes made from year to year for adding to the requirements and comforts of our hospitals, and providing for the sanitary condition of our prisons. That Government has as little to do with charity as with religion, is little remembered by the public of Ceylon. In England, hospitals and dispensaries are supported by voluntary contributions, and large bequests are made by the wealthy for their maintenance and efficiency; whereas in this country, the duty as well as privilege of the rich to provide for the poor is not recognised sufficiently. Beneficence is not without reflex influence on the benefactor. The good Samaritan, who gave pence to support his neighbour, and poured oil into his wounds, "showed mercy on him," and Shakespeare says of mercy:—

* * "It is twice blessed,
"It blesseth him that gives and him that takes."

It would be well if more of our well-to-do citizens followed the noble example of Rajapaksa, the De Soysas, Joseph Fernando, and Harmanis Dias. These are the true benefactors of the people.

The wise and judicious Ordinances which have been enacted may also be viewed in a sanitary light. I need only allude to the Ordinances on compulsory vaccination; for establishment of Municipalities and Local Boards of Health; restricting the use of opium and bhang; regulating the sale of poisons; Medical Aid Ordinance for the planting districts; for administration of village communities; regulating the sale of intoxicating liquors; registration of births, marriages, and deaths; quarantine; irrigation; contagious diseases; and for regulating pilgrimages; nor must I omit to mention the advantages we have derived from the appointment of commissions of inquiry on cholera, prison discipline, and on irrigation.

On the whole, I may say we have no reason to be ashamed of the medical institutions of this Colony. We have one Leper and two Lunatic Asylums, twenty-seven Civil Hospitals, six District Hospitals, and forty-five Outdoor Dispensaries. Our prisons are now model institutions, and while stringent measures are adopted by strict penal discipline to make punishment what it should be, a deterrent from crime, every endeavour is made to ensure the health and maintain the physique of the convict, and thereby render him fit for the hard labour he has to undergo. Juvenile prisoners have been long carefully separated from old offenders, and confined in a separate department of the prison; and an Ordinance has lately been passed for securing their reformation in a Reformatory, and in Industrial Schools. Almshouses for the aged and infirm are urgently required, and have yet to be provided. Friend-in-Need Societies have done much good in the time past; but these institutions cannot now cope with the increasing destitution from the rapid increase of population, and from want of employment. The private charity of the more wealthy members of the community is needed, and must be systematically afforded in lieu of the indiscriminate alms-giving, long the practice of the country. The prevailing distress from poverty and want of employment, however, is such that measures on a larger scale must be devised by the Municipalities, or by Government, not only for the relief of indigence, but for the removal of the causes of pauperism, which invariably produces crime.

Civilisation and its advantages enjoyed by those in large towns have yet to be extended to rural districts, the kóralés and pattus of the various provinces, where, at times, under the influence of drought and unfavourable seasons, sickness occasionally breaks out, and decimates the population. This was remarkably the case in 1864, 1866, and 1875, when fever and dysentery were so remarkably rife. The people were not on these occasions uncared for and left to perish of sickness and starvation. Food was provided by Government;

but medical aid could be given only partially, as the prejudices of the people were then found to be strong against the use of European drugs. With time and better agents for dispensing remedies, these prejudices are being gradually overcome. There are fortunately at the same time influences at works to enlighten and elevate the population. The country is being gradually opened up by roads and railways, and little towns are springing up where formerly there was jungle. Irrigation works are being gradually restored, and will in time reclaim wild and uncultivated wastes, formerly inhabited, but which may now be said to be "pathless forests." We may yet hope that ere long the measures adopted to advance the material interests of the country will help "to scatter plenty over a smiling land." Our missionary societies are extending their operations into the far interior, so that moral improvement, as well as material advancement, may be anticipated. But the means of abating deadly disease are still the feeble simples of the Vedarála, and the charms and incantations of the devil-priest. Shall we not aid the Christian missionary in his work, if, like the "Great Exemplar," we be not at the same time missionary and physician? The good work has been commenced in the Medical College. Let us hope that in time the licentiates of this institution will multiply and be found in all parts of the Island, possessed by knowledge which will enable them to combat disease in its varied forms; safe advisers, who will teach the people to avoid the causes of disease, and thus afford to them the blessing of preventive as well as curative medicine.

THE VEḌDA'S OF CEYLON.

By C. J. R. Le Mesurier, Esq., c.c.s., f.g.s., &c.

Some years ago, while arranging the records of the old Kandy Kachchéri, I came across an account of the Veḍdás, written, so far as I can remember, in the form of an official report to the resident at Kandy in the year 1820. By the permission of the then Government Agent, I took a copy of this document, and since that time have had several opportunities of verifying the information it contained.

I do not think the account has ever been published, at least I can find no record to that effect, and I venture therefore to offer it in the form of a Paper to the Asiatic Society.

I have myself, on several occasions, come across the hill or rock Veḍdás, while shooting on the borders of the Central and Eastern Provinces. My first introduction to them was on this wise.

I was tracking up an elephant at some distance from the Pattipola ár, where my camp had been pitched. We were in the midst of a dense forest, when I suddenly heard the sound of an axe. The elephant had heard it too, apparently, for just about this time we saw from his tracks that he had bolted, and we therefore gave him up.

Turning to my tracker, I asked him who was cutting trees in this out of the way forest, and he replied that it was, he thought, a Veḍdá. I at once dashed off towards the sound, to see what was to me then a curio; but the tracker promptly stopped me, and said, "That is not the way to catch a Veḍdá: he will bolt the instant he hears you, and you will never see him. You must come like this," whereupon he went down on his hands and knees, and crawled

towards the sound. I followed suit, and when we were close up we "rushed" our man. He was in a terrible fright at first, but we soon quieted him, and the tracker, who knew his patois, acted as interpreter between us. After a few words I asked him if he was alone. "No, he had his wife and children, and his brother and his brother's wife with him." I asked him to go and bring them, and he left us for about half a minute, and apparently without a word being spoken, returned with another man, two women, and two children, one being at the breast. A present of tobacco all round, and a few more words and promises of food, &c., from me made them quite friendly. The men visited me in camp next day, and were very useful in the field, from their knowledge of the country and where to find game. Since then, I have come across Veḍdás on several occasions, and the result of my personal experience is, in the main, to confirm the accuracy of the following account:—

The Veḍdás of Ceylon are thought by many to be the aborigines of the country, and their appearance, customs, and language certainly warrant this belief.

They are of two distinct classes, (1) the village, and (2) the rock or hill Veḍdás.*

(1) There is very little social intercourse amongst the pure village Veḍdás. They are said never to meet for any purpose of festivity. They subsist on the game they kill, on the fish they catch, on the roots and seeds of certain aquatic plants, and on yams and other jungle plants and creepers. The country in which they live abounds with elk, deer, wild hogs, hares, monkeys, porcupines, iguanas, peacocks, and jungle fowl, all of which they kill with bows and arrows, except the iguana, which they run down, or "tree," with

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* The village Veḍdá differs but very slightly now from the ordinary Sinhalese villager of the interior. Most of the old village Veḍdá families have either become incorporated in the surrounding villages or have retreated further into the forest, and become hill Veḍdás.

their dogs. They cut the flesh off the larger animals into steaks, and dry it in the sun. In this state it is eaten raw, seasoned with honey or salt, when they can procure it. They eat the flesh of the iguana fresh, but broiled. They also pound to powder the rotten wood of a tree called *bala*, which is said to be like the *kẹkuna*, or country walnut. This they knead into a paste with honey, and then bake into cakes. They are, however, said not to eat this unless they are in want of something more nutritious and palatable, and they explain the addition of the rotten wood to the honey by saying that it is required to fill the stomach. They do not eat the flesh of the ox, the buffalo, the panther, or the bear. Some of the more civilised of these Vẹddás cultivate small patches of kurakkan (a small kind of grain) and Indian corn, and a little tobacco and cotton. They flay the deer, but not the elk. The skin of the latter they dress and eat after singeing the hair. When they have the flesh of these animals in plenty they dress it by boiling, but more frequently by roasting, and the flesh of recently killed animals thus dressed appears to be considered a luxury. When all other means of sustenance fail them, they boil the leaves of the *kora* and *tora* trees, which grow in abundance everywhere in the jungle.

They never kill or catch the elephant. They do not use firearms, and their bows and arrows are not intended for so formidable an animal.* They always avoid him in consequence. The bear and the panther are their most dangerous enemies, the former especially.† Many of the Vẹddás bear the marks of conflicts with it ; but with his axe, which with its short handle is an efficient weapon of defence against an animal that closes with his enemy, the Vẹddá generally

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* They are very bad shots with the bow, and they never "fire" until they are within three or four yards of their game.

† They have a number of charms against these animals, the principal ingredient in them being noise.

comes off victorious, though often severely lacerated, and that usually about the face.

They barter their deer skins, dried flesh, cotton, and honey for rice, kurakkan, tobacco, salt, cloth, arrowheads, and axes. They carry on this trade with the Siŋhalese and Moormen in their neighbourhood. They exercise no art or handicraft but that of making their bows and arrows. The heads of the latter are made by the Siŋhalese blacksmiths. They all have an axe, and some few of them possess a small hoe; but they make little use of the latter in the cultivation of their lands, all they do previous to sowing the crop being to cut the jungle and burn it. They are fond of salt, but as frequently it is not to be had in their neighbourhood, the only seasoning they have for their food is honey.

They are passionately fond of tobacco, and would use betel could they procure it. They, however, find a substitute for it in the bark of certain trees,* which they chew with their tobacco. They do not practise smoking, they have no knowledge of intoxicating liquors, and drink nothing but water. They never cultivate paddy, the reason they give for this being that they are much fonder of hunting. They never do and will not apply themselves to any sort of labour, except now and then to a little high-land cultivation, and that never exceeds a rood or two for each family. They keep no domestic animals excepting dogs, and sometimes, but very rarely, a few fowls. Their huts are constructed in a very rude manner, some of them being a mere roof composed of three or four sloping poles, one end of which is placed in the ground, and the other end is supported by a cross stick placed on two perpendicular ones. Others have a perfect roof coming down to the ground on both sides, like the old military tents. Their huts are generally covered with the bark of trees, but sometimes with dried grass or straw. They never

* It was while stripping one of these trees of its bark that I first came across them.

remain more than a few months in one place, and often shift their residence more frequently.

The men wear a string round their middle, with a piece of cloth of the width of four or five inches passed between the legs, a flap of which about eight or nine inches long hangs over in front. The women wear a piece of cloth about the size of a small handkerchief, and in the fashion of an apron. The hair of both sexes is never combed, and is disgustingly matted and filthy. They wear no ornament in the hair, but sometimes tie a string round the head to keep the hair out of their eyes. They wear small earrings of iron or brass. Their bodies are never washed unless it be by the rain.

They speak Siṉhalese, but it is so corrupted that it is very difficult to understand. They make use of some words that are not Siṉhalese. Their voice is loud, harsh, ill-toned, and disagreeable.*

Polygamy is not practised either on the part of the men or the women. When the females arrive at a proper age, they are asked by the young men from their parents, who never refuse their daughter to the first suitor. No marriage presents are given on either side, nor is there ceremony or marriage feast. The bridegroom merely calls, as they express it, the bride from the hut of her parents to his own.† Their wives are generally prolific, but the great majority of their children die of fever when young. They speak most favourably of the fidelity of their wives, and assert that their caste is distinguished for chastity. They never repudiate their wives, whose duties are purely domestic, except that they assist in reaping the kurakkan. They are kindly treated by their husbands. As to the relative rank

* Many of the hill Vẹddás that I have come across appeared to have lost the power of modulating their voice, probably from disuse.

† The bride ties a string round the bridegroom's waist, and they are man and wife.

of the females, it is asserted that the men have more regard for their wives than for their brothers and sisters.

Strangers who reside in their country for any number of days seldom escape jungle fever, and they are not a little exposed to the baneful effects of the climate themselves. Besides fever they are subject to cutaneous complaints; but it does not appear that either venereal disease or small-pox is known among them. They attribute all sickness to the agency of malignant spirits, with whom they believe their country to abound. The use of medicine of any kind is not practised among them. They trust entirely to incantations to propitiate the demon who has afflicted them. In all cases of severe sickness they devote a silver ring and a piece of cloth, which are deposited in a particular place. After this, the Yakdesa, or demon priest, who is always one of the eldest of their own tribe, is sent for, and he dances and chants certain incantations before the sick persons. He is then fed with what they have to give him, which generally consists of the cakes made of honey and rotten wood, and the ceremony is concluded by his carrying off the ring and cloth offered in sacrifice from the spot where it was laid. They pay no respect to the dead. The body is thrown into the jungle without ceremony, to be devoured by wild beasts.

Of an all-powerful beneficent being they have no idea, but they believe in the existence of a plurality of malignant spirits. Of a future state they have no notion, and are equally ignorant of the religion of Buddha and the gods of Hindu mythology.*

Their knowledge and moral notions appear to be as limited as their mode of life. They cannot count beyond five, and the stupidity and apathy of some of them is very striking. There is, however, something in their manner, when in their native forests, like the independence or indifference that may

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* They also believe in the fostering care of the spirits of the dead, whom, with the sun and moon, they constantly invoke in time of need.

be expected in a savage. One of them, on being asked to show how they steal upon their game, gave a most striking specimen of good acting. The keenness and intensity of his eye, the lightness of his step, and the eagerness of desire displayed in every limb and muscle of his body, could only be compared to those of a cat or a tiger stealing upon its prey.

Their whole appearance bespeaks the hardiness of their condition. They are lower in stature than the ordinary Sinhalese, but are meagre in their bodies and squalid in their looks. Their figures denote that they might be active in their movements, but they give no indication of being possessed of much strength either of body or constitution. Their limbs, however, though thin and slight, are well turned. They are generally of a darker complexion than the common Sinhalese, though some are of a much lighter shade than the others. When not in the jungle they carry a white staff about seven or eight feet long, and when they stand, they plant this before them, grasping it with both hands a little above the height of their forehead, and bend forward in a most unmeaning and ungraceful position.

(2) The hill Veddás are of the same caste and description as the others, their habits and customs are much the same, but they are described as being of a savage and ferocious disposition.* Persons who approach them are considered to be in danger, and they are said to be at enmity with all their neighbours.† There were certain seasons when the Veddás had to render a tribute of honey and flesh to Government, but, as the wild Veddás never entered a town or a village, the Veddás of Horabora used to repair to a certain place near their haunts, where they found the honey and dried deer's flesh deposited. They, however, seldom saw the people

* The hill Veddâs are fast becoming extinct, first, from constant intermarriage between members of the same family, second, from the decrease in the game of the country, and the consequent privation and lack of food.

† N.B.—This was written in 1820.

themselves, and when they did they avoided them as dangerous.

Both the wild and village Veddás rank with the Vellálas (the highest Sinhalese caste). When the more civilised Veddás go to the house of a district chief of the Vellála caste, they receive water out of an earthen pot with a spout to it, a privilege that belongs only to the Vellálas.

The men among the wild Veddás are still more scantily clad than their neighbours, for they wear no cloth, but only a small apron of plaited leaves. The women are scarcely ever to be seen. They remain in the deepest recesses of the wood, or among the rocks in the hill country, and are as naked as the men.

The hill Veddás speak a language that is not understood either by Sinhalese or Tamil, but some few words of the Sinhalese language are to be recognised in it.* They hold no intercourse with their more civilised neighbours, and it is, as above stated, considered dangerous to go near the places of their resort. They are quite migratory in their habits and mode of life, remaining but a day or two at a time in one place. They have no huts, but take shelter under large trees or rocks. They have a fire constantly burning, which they produce by the friction of one piece of wood upon another. They live solely on what nature affords them, on roots, fish, and the game they kill with their bows and arrows.† They

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* Notwithstanding all that has been said to the contrary, I believe the Veddâ language to be merely a patois of the ordinary Sinhalese. Many of their words can even now be traced to a Sinhalese origin, such as, for instance:—

To drink—*diya-kanawa*=in Sinhalese, to eat water.

To sleep—*nidenawa*=in Sinhalese, *nidagannawa*.

Snake—*polongo*=in Sinhalese, *polonga*.

Lightning—*gini wetuna*=Sinhalese, fallen fire, &c.

Considering that they have no knowledge of letters, no literature of any sort, nothing to arrest the constant change in their spoken language, it is remarkable that any indication of the affinity of this patois to Sinhalese should have remained.

† The constant change in their residence is due to their search after game.

cultivate no kind of grain, and make nothing but their bows and arrows. The iron heads of the latter and their axes they obtain in the following manner:—They carry a quantity of dried flesh and honey to a place near the residence of a Siŋhalese blacksmith, and hang it up on a tree out of the reach of dogs and jackals, together with a leaf cut in the shape of the iron article they want. The smith fails not to accept the offer thus made to him, and in due time hangs up in the same place the article required in return. It is understood were he to fail in doing so, that he would be exposed to the most dreadful vengeance of the Veḍdá and his friends.*

It is the general belief that the hill Veḍdás are extremely tenacious of the chastity of their wives. They are consequently apt to be jealous, and instances are not wanting of their sacrificing to their revenge both the wife and the supposed paramour; but all speak in high terms of their kind treatment of their wives, and of the fidelity of the latter to their husbands.

The hill Veḍdás living along the frontiers of the Kandyan and Maritime Provinces never acknowledged by tribute either the Dutch, British, or Kandyan Governments; but those towards Horabora in Bintẹnna paid a tribute of flesh and honey at three different seasons of the year to the royal stores at Kandy. This they of their own accord, at the proper time, hung upon a tree, and it was brought from thence by the Veḍdás of Horabora, as has already been noticed. The officer whose duty it was to collect the tribute never had any personal communication with the hill Veḍdás, and having no control over them he could not have enforced the payment had it been withheld. There was, however, no known instance of their ever having failed to pay in due time.

They never commit depredations upon the crops or property of any kind belonging to their civilised neighbours,

* This custom has fallen into disuse.

nor do they molest traders or travellers on the commonly frequented paths that lead through the country they inhabit. It is dangerous to offend them, and instances are known in the Batticaloa district where they have revenged an injury by deliberate assassination.

In Major Johnstone's expedition from Batticaloa to Kandy, in 1804, the first person that fell was brought down by the arrow of a Veḍdá. On the march of the detachment through the Veḍdá woods between the Nadakáḍu province of the Batticaloa district and the frontier of Wellassa, a small clear spot was chosen to encamp on for the night. It was on the side of a wood which a party of the pioneers entered for the purpose of procuring firewood. It happened that a few Veḍdás had here taken up their temporary abode. They fled on being discovered by the pioneers, who at once proceeded to plunder the little property they had left in their huts, the most valuable part of which consisted of two or three fowls, who, like their owners, sought safety in the jungle. While one of the pioneers was pursuing a fowl, a Veḍdá concealed in a bush shot him through the loins. This happened but a few yards from the camp. The wounded man was brought in alive, and the arrow was extracted by the medical officer, but he died in a few hours. The Veḍdás effected their escape. An instance of their mode of taking revenge took place in the Batticaloa district about 1822. One of the more civilised Veḍdás, a lad who had established a friendly intercourse with a hill family, conceiving an attachment to a young female of the family, made proposal to the parents for her. The match for some cause or other did not come off, and shortly after the girl sickened and died. The family attributed her death to necromancy practised by the young man, and under this impression, four or five years after, a brother of the young woman left the woods in search of the object of his revenge, and having found him watching a paddy field in the Batticaloa district, walked up to him in the open day, and deliberately shot him through the body.

This was done in sight of another man, a Malabar, who was in the same field at some distance, and from whom the Vẹddá had ascertained the identity of the man he was in search of. The assassin, after withdrawing the fatal shaft from the body of his victim, made his escape into the woods.

They are not only ready thus to redress their own grievances, but also those of their friends; and this disposition was sometimes taken advantage of by the Moormen and Malabars, who were in the habit of intervening between those who are in a sort of semi-civilised state, and the absolutely unsocial and uncivilised Vẹddás. An instance of this also took place in the Batticaloa district, about the same time. A headman of the Province of Pattipal having rendered himself obnoxious to the chena cultivators near the Vẹddá country, a party of Vẹddás came down quietly in the night to the village where the headman was residing at the time, surrounded his house, plundered it, and put him to death. In short, the disposition of the hill Vẹddás was so well known that the Siṇhalese, Malabar, and Moor families, from whom the petty chiefs placed over the partly civilised tribe were generally taken, both in the interior and the Batticaloa district, were objects of dread amongst their neighbours from the influence they possessed over such ready instruments of revenge.

In regard to their origin, it is remarkable that the traditional accounts of them given by the best informed Kandyan chiefs, and the most intelligent Tamil inhabitants of the Batticaloa district, perfectly accord with each other.*

* The historical origin of the Vẹddás is as follows:—When Wijayo landed in Ceylon, he married Kuwena, the daughter of a Yakko chief. She betrayed her people into his hands, but when she had served his purpose he deserted her. She returned to her people, but they were so incensed with her that they put her to death; and her two children by Wijayo only escaped the same fate by the intervention of their uncle, who fled with them into the forest near Adam's Peak. Some time after the brother and sister married, and founded a wild race, who kept aloof from all their neighbours, retreated into the forests of Wellassa and Batticaloa on the approach of the Indian invaders, and became "the wild men" of Knox—the Vẹddás (or hunters) of Ceylon.

The Kandyans say that the Veddás are real Sinhalese Vellálas, who at a period of very remote antiquity occupied the tract of country which now constitutes the district of Batticaloa. That they were expelled from thence by an invasion of Tamils from a foreign country, and took refuge in the forests in which they are now met with. They would not mix with the other inhabitants of the country, but to criminals and other unprotected fugitives who took refuge amongst them, and to slaves who fled from their masters, they generally afforded hospitality and protection, though they were apt to deliver them up for presents in cloth, &c.

They are totally unacquainted with letters, but the different tribes hold a rude correspondence with each other by small pieces of wood cut into different shapes. Fugitives used to be furnished with passports of this kind, when they removed from one tribe to another, and the treatment they received depended on the recommendation which the talisman conveyed.

Man in a state of nature, or in any degree approaching it, is ever an object of curiosity to the civilised world. The knowledge of the existence of the Veddás of Ceylon must therefore excite a wish to be acquainted with their origin and history. From themselves, however, no information whatever can be obtained. They trouble themselves little about futurity, and the past is a blank to them. They are said to have been in the habit of addressing the King of Kandy by a word which signified "brother"; but this was merely due to the poverty of their vocabulary, as the word *aluwa** is used by them when speaking of or to all persons with whom they are in friendship, and in consideration of this they were allowed to use this familiar term in the presence of the late king, a liberty that would have cost any other of his subjects their lives.

* Bailey, who, by the way, says that the word is "hoon" (cousin), attributes this familiarity to the fact that the Veddás claimed and were acknowledged to have a royal origin.

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THE VEḌDÁS OF CEYLON,

AND

THEIR RELATION TO THE NEIGHBOURING TRIBES.

Translated from the German Monograph of Professor R. Virchow.

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Explanation of the Tables.*

TABLE I.—Skull of a Veḍdá Woman from the Museum at Colombo, Ceylon.

TABLE II.—Skull of a Siŋhalese.

TABLE III.—Skull of a Tamil from Ceylon.

All the views are by Mr. E. Eyrich, taken according to the geometrical method, and reduced to one-third the natural size.

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* Not reproduced.—*Hon. Sec.*

ERRATA ET ADDENDA.

Page 351, note ‖, *for* "p. 124" *read* "p. 62."
,, 352, line 2, *for* "Van Goen" *read* "Van Goens."
,, 353, note ‡, *for* "Norasa" *read* "Novasa."
,, 358, note *, *for* "p. 123" *read* "p. 62."
,, 358, note †, *for* "p. 126" *read* "p. 63."
,, 359, line 30, *for* "Taylor" *read* "Tylor."
,, 359, note *, *omit* "Die omfánge der cultur übers."
,, 359, note †, *for* "Taylor" *read* "Tylor."
,, 359, note †, *for* "Spang" *read* "Spangel."
,, 368, note †, *for* "Zuitf." *read* "Zeits. für" *passim.*
,, 378, note *, *for* "Mokna" *read* "Mokua."
,, 381, line 2, *for* "Ẹlu" *read* "Eḷu."
,, 381, note *, *for* "p. 104" *read* "p. 61."
,, 384, line 12, *for* "κολορα" *read* "κολοβὰ."
,, 387, last line, *after* "precipices" *insert* "(λιθίνοις σπηλαίοις)."
,, 388, line 16, *for* "Zvortvan berwe beandend," &c., *read* "Zwart van verwe, brandend," &c.
,, 394, line 6, *after* "Skull No. 1" *insert* "(Table I.)."
,, 394, line 11, *for* "Dewilané" *read* "Denilane."
,, 398, line 13, *for* "Busle" *read* "Busk."
,, 398, line 14, *for* "two last" *read* "last two."
,, 398, line 31, *after* "Museum," *insert* "(Table I., Fig. 3)."
,, 399, line 21, *for* "Weleker" *read* "Welcker."
,, 402, line 11, *for* "*occipitale*" *read* "*occipitalis.*"
,, 404, line 10, *for* "76" *read* "7·6."
,, 404, line 12, *after* "skull" *insert* "(Flower, No. 683)."
,, 406, line 16, *for* "chamæprosopous" *read* "chamæprosopic."
,, 406, line 29, *after* "skull," *insert* "(No. 675)."
,, 406, line 35, *for* "alreolar" *read* "alveolar."
,, 406, line 36, *for* "basilar alvesli" length *read* "basi-alveolar length."
,, 407, line 2, *for* "basinasel" *read* "basinasal."
,, 409, line 2, *for* "Bernard" *read* "Barnard."
,, 411, line 18, *for* "von" *read* "van."
,, 411, line 19, *for* "vrijser ruf tig" *read* "vrij vernuftig."
,, 411, note *, *for* "Tambulus" *read* "Jambulus."

ROYAL ASIATIC SOCIETY,

CEYLON BRANCH.

THE VẸDDÁS OF CEYLON, AND THEIR RELATION TO THE NEIGHBOURING TRIBES.

By Professor R. Virchow.

Translated for the Ceylon Asiatic Society from the Memoirs of the Royal Academy of Science of Berlin, 1881.

In the various mixture of races inhabiting the Island of Ceylon, the Vẹddás (Vaeddas, Weddas, Veddahs, Vaddahs, Vaidahs, Beddas, Bedas) have since a long time been an object of special prominence for the study of ethnography, because, owing to an inferior order of intellectual development, and through defects in physical organisation, it offers the most room for conjecture that here is presented a remnant of the aboriginal inhabitants. And now, when according to all accounts their number is so rapidly diminishing that at no very distant date its last members will have disappeared from among the living, it adds peculiar interest to the study that it is desirable to transmit to posterity at least a trustworthy picture of its singular characteristics. For this the material we now have is nowise sufficient: hence the task for the following disquisition is not merely to collect what has been already arrived at, but to point out the gaps which can be supplied only by farther local researches. It is to be hoped that this may stimulate to the immediate application of all possible means to obtain the wanting material.

The Vẹddás have dwelt—at least for some centuries—in one district in the eastern, or more correctly, south-eastern part of the Island. Robert Knox, who gave the first exact information regarding them in the year 1681, transferred them to the woods of "Bintan" (Bintẹnne).* John Davy† in the early part of this century speaks of them as inhabiting the vast forests on the south-east side of the Island, between the mountains and the sea, especially the wild, unhealthy tracts of land called *Vẹdirata* of Bintẹnna and *Mahavẹdirata* of U'va. These they consider as their own territories. On the whole their boundaries remain the same to-day. Sir E. Tennent‡ and Mr. Bertram F. Hartshorne§ assert that the Vẹddá-land is about ninety English miles in length and forty in breadth, from the hills of U'va and Mẹdamahanuwara toward the east and extending to the sea coast, while Mr. Pridham,‖ who estimates the area at very nearly 1,500 square miles (English), bounds it more precisely in the following way: Batticaloa on the east, the districts of Mágampattu and U'va on the south, the mountains of Kandy on the west and south-west, and the river Mahavẹli-gaṇga on the north. Mr. John Bailey¶ states that the majority of the real Vẹddás dwelt in the districts of Batticaloa and Badulla (chiefly in the former); but here it should be said that according to a later division of the country a part of Bintẹnna has been added to the district of Badulla, and the larger portion of it

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* Robert Knox. An Historical Relation of the Island of Ceylon in the East Indies. London, 1681, p. 61. New edition, printed in Philalethes. The History of Ceylon from the earliest period to the year MDCCCXV. London, 1817.

† John Davy. An Account of the Interior of Ceylon and of its Inhabitants, with Travels in that Island. London, 1821, pp. 115, 116.

‡ Sir James Emerson Tennent. Ceylon: an Account of the Island, Physical, Historical, and Topographical. London, 1859, vol. II., p. 437.

§ Hartshorne, in the *Fortnightly Review.* London, 1876. New series, vol. XIX.

‖ Charles Pridham. An Historical, Political, and Statistical Account of Ceylon and its Dependencies. London, 1849, vol. I., p. 452.

¶ John Bailey, in Transactions of the Ethnological Society. London, 1863. New series, vol. II., p. 278.

to the district of Batticaloa.* The more savage remnant of the tribe live in the beautiful province of Nilgala and in the forests of Bintẹnna.

There is much evidence, however, that in times not very distant the Vẹddás were scattered over a much larger extent of territory. The name "Vẹddá-land" (*Vẹdiraṭa*) in the time of Mr. Bailey (1863) belonged to extensive districts in the north-east of the Kandy mountains, which were no longer inhabited by the Vẹddás, but by the Siṇha-lese (Wanniyas). The designation *Mahavẹdiraṭa* ("Great Vẹddá-land") seems of pretty wide application. Davy, who in one place transfers it to U′va, in another† gives it to the far-reaching flat lands in which the so-called "lake" of Bintẹnna lies. Mr. Pridham, who indeed was never himself in Ceylon, places *Mahavẹdiraṭa* in Wellassé and a part of U′va. These are subordinate matters, however. More important far are several earlier statements. Cordiner‡ tells us, after mentioning the real Vẹddás, that "another race of a similar description formerly existed in the district of the Wanny, bordering on the province of Jaffnapatam. They are now, in some degree, civilised." They spoke Malabar, and adhered to the Brahmin religion. In another place he says§ that at the advent of the Portuguese the "Bedahs" dwelt in the north and the Siṇhalese in the south. This seems to prove that the Vẹddás formerly reached much farther northward. But their earlier presence in the south and even south-west is also proved. Knox‖ tells us that at "Hourly," a remote possession of the king of Kandy, numerous Vẹddás were living, who were, however, pretty tame; and Valentijn¶ mentions, besides "Vintana" and "Hoerli," still another

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* Bailey, *l. c.*, p. 281, note.

† Davy, *l. c.*, p. 377.

‡ James Cordiner. A Description of Ceylon. London, 1807, vol. I., p. 91.

§ *Id.*, p. 137.

‖ Knox, p. 124.

¶ François Valentijn. Oud en Nieuw Oost Indie. Dordr. en Amsterdam, 1726. Deel V. Ceylon, p. 49.

"Beda" district, farther north than Trincomalee. Bergk, the translator of Percival's work,* says that Van Goen states the "Bedahs" had entire possession of the land between the mountains of "Canducarre" in the west and Passara in the north; while Percival counts† as belonging to them not only the Indians in the adjoining province of Jaffnapatam, but the tribes inhabiting the western and south-western part of the Island between Adam's Peak and the Rayigam and Pasdum kóralés.

In regard to these statements, I remark that Bergk's view of the situation of the district mentioned is erroneous, as a glance at the map by A. Arrowsmith,‡ contained in the book he translated, would have taught him. The district of "Canducarre" (according likewise to the map of Ceylon published by J. Mawman, 1816, which is appended to the new edition of Knox) lies at the east of the Island, S.S.W. from Batticaloa, as well as the immediately adjoining district of Passara, which is a province of U'va directly north of it, and close to Badulla.§ From this the country between "Canducarre" and Passara would be the real Vęddá territory, whereas the Rayigam and Pasdum kóralés lie on the west coast south of Colombo, in the neighbourhood of Saffragam and south-west of Adam's Peak.

Mr. Bailey,‖ in whose time indeed there were no longer any Vęddás living there, conjectures that Saffragam (from its old name *Habaragamuwa*) was the original land of the Vęddás (*habara*, "barbarian"), and as proof of this gives a variety of local names still extant. He also finds in a Siṇhalese poem, written about four hundred years ago, *Parawi*

* Robert Percival. Description of the Island of Ceylon, translated by J. A. Bergk. Leipsic, 1803, p. 337, remarks.

† Robert Percival. An Account of the Island of Ceylon, containing its History, Geography, Natural History, with the Manners and Customs of its various Inhabitants. Second edition, London, 1805, pp. 282–284.

‡ The map in Tennent's work is by John Arrowsmith.

§ Davy, *l. c.*, p. 413. Pridham, *l. c.*, I., p. 361.

‖ Bailey, *l. c.*, p. 313, note.

Sandése, the district right below Adam's Peak distinctly inhabited by Vẹddás. Possibly only some scattered remnants of the tribe dwelt among these mountains.

That four hundred years ago the Vẹddá territory extended continuously in this way as far as the west side of the mountains, and even to the western sea coast, is highly improbable, as a Chinese geographer, Hiouen Thsang, in the seventh century of our era, travelling in India states that the Yakkhos had* withdrawn into the south-east corner of Ceylon. It may, however, be correct that as Sir E. Tennent asserts, under the Dutch Government Vẹddás were found in large numbers, but half civilised, at no great distance north of the peninsula of Jaffna, in the so-called Wanni. The question whether in the earliest ages Vẹddás inhabited the whole Island I will take up later.

The present Vẹddá-land is very lovely, embracing a comparatively flat, wooded country, nowhere raised more than two hundred feet above the level of the sea, but frequently having the appearance of a park. It would seem that the character of the soil varies, since dams and unwholesome marshes alternate with rock-ribbed hills. The Rev. Mr. Gillings† speaks of the province of Bintẹnna as very dry and rocky. But Mr. Frederick Müller‡ is mistaken in transferring the home of the Vẹddás to the mountains of Ceylon. All the more recent accounts limit their abodes to the anterior land which separates the central mountains from the sea coast, excluding them wholly from the mountains themselves. Sir Emerson Tennent§ to be sure makes a distinction between the somewhat more civilised village and coast tribes, and the wild "Rock Veddahs, *galle-vedda.*"

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* Tennent, *l. c.*, I., p. 372, note.

† The Journal of the Ceylon Branch of the Royal Asiatic Society. Colombo, 1853, p. 89.

‡ Reise der östere. Fregatte Norasa. Anthropologischer Theil. Abth. III. Ethnographie. Wien, 1868, s. 139.

§ Tennent, *l. c.*, II., pp. 439–44.

If we reject his attempt to identify these with an ancient tribe of "Gallas," who may have dwelt in the same portions of the south as the present Galle, and admit that the rocky character of the region in which the wildest part of the tribe live accounts for the name, evidently given them by strangers, it does not by any means follow that the rock Veddás are mountaineers. For centuries the real inhabitants of the mountains have been Sinhalese, the people of *Máyárata.* Sir E. Tennent established the rock Veddás, who, according to him, had split into five clans or hunting-parties in the woods of Bintenna, and whilst the village Veddás, amounting at the highest estimate to not more than one hundred and forty families, lived in nine small communities around the Laguna district of Batticaloa, the coast Veddás, four or five hundred in number, roamed about in the jungles between Batticaloa and Trincomalee, chiefly in the vicinity of Erávúr and along the coast as far as Vendeloos Bay. Mr. Hartshorne, however, rejects this division wholly; he distinguishes only *Kelé-Veddó* (jungle Veddás) and *Gan-Veddó* (half-civilised village Veddás), the former only as deserving the special attention of ethnologists.

If we study the map of Ceylon, it becomes at once clear that Bintenna, the ancient capital, which Sir E. Tennent speaks of as identical with the *Maagrammum* of Ptolemy,* lies directly upon the eastern boundary of the mountains towards the foreland. The Maháweli-ganga, the largest river of the Island, here bursts out from the hill-country, behind which the mountains of Kandy and U'va rise westward; to the east are fertile plains, swamp lands, and

* Tennent, *l. c.*, I., p. 536, note 2. This he rests on the old name of Bintenna having been Mahiyangana, and asserts that this could not possibly mean Mahagan, as was assumed by Christ. Lassen. (*De Taprobane insula veteribus cognita. Diss. pro aditu, muneris prof. ordin. Bonnae, 1842,* p. 23.)

extensive forests, interspersed with low hills. Sir E. Tennent* paints in rich colours this beautiful country, which he passed through on his way from Bintenna to Batticaloa on the east coast. This is the real home of the Veddás. Knox† also describes very distinctly this country,—this land of Bintenna,—which he surveyed from afar on the tops of the mountains. He says: "It seems to be smooth land, and not much hilly; the great river runneth through the midst of it. It is all over covered with mighty woods and abundance of deer; but much subject to dry weather and sickness. In these woods is a sort of wild people inhabiting." The wild Veddás live here in perfect isolation, as well from their allophylen neighbours as their more civilised tribal brethren, without fixed abodes, but yet upon their own recognised lands, mostly in small groups, or simply in families. Rarely do they venture beyond their own boundaries, and then only for the purpose of exchanging honey, wax, skins, or venison for tools of iron (axes, arrow-points, &c.). For the most part they shrink timidly back from all human contact, and even their small commerce was not at first openly pursued,‡ but in

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* Tennent, *l. c.*, II., p. 451.

† Knox, *l. c.*, p. 9.

‡ Mr. Hartshorne asserts that this mysterious way which Sir Emerson Tennent made so much of is no longer carried on. The first mention of it is by Knox. Earlier authors, in speaking of the secret trade, refer, as far as I can see, not merely to the Veddás, but to the Ceylonese in general. It does not appear to me at all certain that the passage in Pliny (Natur. Hist. Lib., VI., 24), in spite of Sir E. Tennent's plea (*l. c.*, I., p. 571, note 1), refers to the Ceylonese, as it does not describe the trade in the interior of the country, but outside, near the boundary of the Serae,—far away upon the continent,—exhibiting it more as a peculiarity of the Serae than of the Ceylonese. The interpretation put upon the passage is of little importance, however, as Chinese authors—for instance, Fa Hiaen—mention this kind of secret trade in the third century as carried on upon the Island itself. That Pliny at the same time refers to the worship of demons certainly would seem to point to the Veddás, but on the other hand a report by the Arabic geographer Albyruni (1030 A. D.) shows that in his time the secret trade was pursued along the coast. We should therefore have to assume that the Veddás carried on a coast trade in the eleventh century, which is not probable.

this wise: they deposited their wares and rough models of the things they wanted in a certain place, and returned later to take away secretly the needed articles. This explains why the estimates of their present number vary so much.

Cordiner says, most indefinitely, "not many thousands in number"; whilst Sir Emerson Tennent,* in the year 1859, considered the estimate at that time of 8,000 an exaggerated one. Mr. Bailey, in 1863, declared the number of the Ṿeddás in the district of Batticaloa to be only about 250, in Nilgala 72 (in 1858), and in Bintẹnna 364 (in 1856),—altogether only about 686. Mr. Hartshorne speaks of these figures as probably too small; and a communication from the Rev. Mr. Gillings† seems to corroborate this, according to which, by the census of 1849, in the district of Bintẹnna alone there was a population in all of 1,538 persons,—half-Sinhalese, half-Veddás. At any rate, from the declarations of Mr. Bailey there is no question that the recruits are very small indeed, and the annihilation of the entire tribe imminent. For he found‡ in Nilgala among 72 persons, 50 adults and 22 children (in one family of 9, and another of 8 adults, only 1 child in each); and among the 50 adults but 14 over fifty years of age; a single member only seemed to be over seventy years of age. Of 308 persons in Bintẹnna, 175 were adults and 133 children; in an isolated horde 22 adults and 4 children. And as if to make this more conclusive, we are assured that there are no indications anywhere of the practice of child-murder among them.

Of late the process of annihilation seems to have hastened on. From a note of the Rev. Somanader, a missionary in Batticaloa, which I received through the kindness of the Director of the Museum in Colombo, Mr. A. Haly, we are led to think there are scarcely any pure blooded Ṿeddás living; he calls them "a race almost entirely extinct."

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* Tennent, *l. c.*, II., p. 444. † Gillings, *l. c.*, p. 83.
‡ Bailey, *l. c.*, p. 296.

Whether this assertion applies to a particular district or is universal, and whether the extinction has been hurried on by a general dying out or through intermarriages with other tribes, I have not been able to discover from the information given me. We can do little more at this distance than to hold together what has been furnished us by observers, who had opportunities of intercourse with living Veḍdás in their own home. Among these we must name above all, Dr. Davy, Sir Emerson Tennent, the Rev. Mr. Gillings, Mr. Bailey, and Mr. Hartshorne. But we encounter at the outset a peculiar obstacle, viz.: that each fresh writer designates the statements of his predecessor as "incorrect." Mr. Bailey* criticises Sir Emerson Tennent in the severest manner, and Mr. Hartshorne,† who on this point agrees with him also, calls in question the accuracy of Mr. Bailey's statements.

Yet Mr. Bailey was many long years in Ceylon. First, as a member of the Government in the district of Badulla, and later as Principal Assistant Colonial Secretary of Ceylon, affording him sufficient opportunity to study the Veḍdás. He puts great emphasis on the fact, and reiterates it frequently, that his statements are sustained by well-tested and often repeated personal observations. It appears to me that the contradiction between Messrs. Bailey and Hartshorne is not in reality so great as the latter pictures it. I find

* Bailey, *l. c.*, p. 279, note. "His [Tennent's] account of them is in some important instances defective, and even inaccurate. He glances casually at those tribes which are in the wildest state, touching with precision none of their peculiarities, and dwells in detail upon those only who from long association with the Singalese and Tamil races have lost much of their originality. Of the ancient aborigines he has compiled much that is curious. Of the existing Veddahs he has given us little besides an epitome of former notices."

† Hartshorne, *l. c.* "They have been described by Sir Emerson Tennent and by Mr. Bailey; but interesting as their accounts are, the latter has suffered grievously from misprints, and the value of the former is impaired by the circumstance that its materials were not the fruit of original research."

that in the space of more than twenty years which intervenes between the two accounts, the effects of educating influences pressing in from all sides upon a before almost isolated people is very noticeable, and explains in the most natural way how certain habits and customs disappear, and others come in. I am therefore inclined to value more highly the testimony of the older observer for his time, than the younger observer is inclined to warrant. But I believe I must defend their distinguished predecessor, Sir Emerson Tennent, against them both. His representations bear throughout the character of great soberness and objectivity; and his facts differ in the main points very little indeed from those of his successors, especially the more immediate one. We cannot in justice deny that he was the first to throw light on this subject.

For all this it is very dangerous under such circumstances to decide, at our distance, where the mistakes are, and what is to be accepted as true; and nought remains but to confine ourselves to such changes as can be clearly traced and followed in their development, or to matters about which the various observers agree. Fortunately there is enough to disclose to us the main characteristics of the people. The greatest difficulty here arises from the fact that not a few of the travellers who have treated the subject of the Veddás—notwithstanding a long residence in the Island—have never personally seen any of them, and speak only from hearsay; and others certainly have not encountered the really wild families. Even Knox,* who never saw a single Veddá, and yet furnishes a likeness of one, distinguishes a "tamer sort," who lived under a kind of subjection to the king of Kandy, and a "wilder," who were called "*Ramba-Vaddahs*."† Davy,‡ who divides them into village and forest Veddás, seems only to have seen the former, yet feels justified in assuming from the information he received that both

* Knox, *l. c.*, p. 123. † *Id.*, p. 126. ‡ Davy, *l. c.*, pp. 116, 118.

belong to the same race. In this all later observers entirely agree. Hence, for the study of their physical condition we may without hesitation unite the two groups, so far as they are not already united ; but for the observation of their social and psychical conditions we must hold the two groups strictly apart : of course in the latter respect only are the forest or jungle Veddás of any interest to us. I shall therefore speak mainly of them ; nevertheless we may not venture quite to set aside the village Veddás, since their actual settlement and civilisation has succeeded only very imperfectly as yet.

As a matter of fact, all attempts to bring the Veddás into fixed abodes and to raise them to a higher culture have suffered shipwreck in far greater measure than the efforts to civilise the Australians. Government officials and missionaries have been active among them many years, but their success has been wholly external. Rev. Mr. Gillings states that up to 1844, in Bintenna, 163 men, 48 women, and 85 children had been baptised—since then very few ; and adds, " but almost all of these have gone back again to their former habits and follies : what they formerly heard they have forgotten." The Veddás have remained on the whole nomadic heathens, and heathens without any developed form of religion. "They are a horde of 'Free-thinkers,'" said Wolf,* " following the impulses of their bad and savage natures." Whether they actually have any conceptions of God or God-like beings is, to say the least, very doubtful. The only thing that is proved is a lower kind of demon worship among them, which here and there assumes the form of a worship of their ancestors. If Mr. Taylor† designates this as *animismus*, and therefore " their religion," as corresponding to that of the barbarous tribes of India, we

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* Joh. Chr. Wolf. Reise nach Zeilon. Berlin u Stettin, 1782. Th. I. S. Die omfánge der cultur übers.

† Edward B. Taylor. The Beginning of Culture. Translated by Spang u Poske. Leipsic, 1873. Bd. I. S., 51.

at least must not overlook the fact that it is also close upon the borders of Nihilism. Gillings says they believe the souls of their departed relations to be devils, who have power to hurt them, and therefore they perform ceremonies to them at regular seasons, and especially when they are sick. Bailey and Hartshorne described these matters in detail.

The former* distinguishes the conditions as they were in Bintẹnna from those of the more barbarous inhabitants of Nilgala. There, he says, they had mourned and buried their dead for a long time ; here they had only just begun to do so. Formerly they threw their dead into the jungle,† or left them just where they died. After covering the body with leaves they laid a heavy stone upon the breast, and sought for themselves another cavern, giving up the one where death had entered to the spirit of the departed. This spirit (*yakun*) watches over the welfare of those left behind. The spirits therefore of their ancestors, like those of children, are good spirits (*néhya yakun*) ; they come to their relatives when they are ill, visit them in dreams, and grant them flesh of the chase. In every trouble the Vẹddás invoke these spirits, especially the spirits of children (*bilindu yakun* or *vitera yakun*). Among their ancestors the great grandmother (*mahakiriammá*) seems to have occupied the first place, although Mr. Bailey is not quite sure whether this distinction is to be understood in the good sense. The spirits are invoked with dance and song, around an arrow, which is planted upright (*Maha kiri amma*).

The description given of all this by Sir E. Tennent‡

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* Bailey, *l. c.*, pp. 296–301. † Davy, *l. c.*, p. 117.

‡ "When sick, they send for the devil dancers to drive away the evil spirit who is believed to inflict the disease. The dance is executed in front of an offering of something eatable, placed on a tripod of sticks, the dancer having his head and girdle decorated with green leaves. At first he shuffles with his feet to a plaintive air, but by degrees he works himself into a state of great excitement and action, accompanied by moans and screams, and during this paroxysm he professes to be inspired with instructions for the cure of the patient." (Tennent, II., p. 442.)

almost reminds one of the customs of the Schamanen. Sometimes, while preparing for the chase, the spirit is promised a piece of flesh of the slain animal. At other times they cook something and put it in the dry bed of a river or other obscure place, invoke the souls of the departed, dance round the food, and perform their incantations.

Sir E. Tennent also reports that the dead were not buried, but simply covered over with shrubs and leaves in the jungle. On the other hand the Secretary of the Ceylon Branch of the Royal Asiatic Society* (1853) tells of their wrapping the dead in mats and burying them ; and Mr. Hartshorne† knows of no other practice than burying. When a person is dead they envelop him in the skin of an animal, and dig a grave for him with their axes or pointed sticks. Women are not allowed to be present. No weapons or utensils of any kind are buried with him, and once closed over they never visit the grave again. To the spirit of the departed one, who has now become a yakká, an offering is brought in the following way: While invoking the spirit they roast the flesh of the *wandurá* (monkey) or the *talagoyá* (iguana) with honey and edible roots, and distribute it among those present, who eat it on the spot. The word *yakko*, or *yakkho*, designates, according to Turnour,‡ a kind of demon, though the demon worshippers are also called Yakkhos and Yakkhinis. He derives it from the root *yaja*, "to bring offerings." This word has for a long time justly excited the attention of scientists, since in the great historical work of Ceylon, the Mahávaṉso, the earliest inhabitants of the Island are called by this name.

When Wijayo, the founder of the first known Ceylon dynasty, in the year of Gotama Buddha's death, 543 B.C., landed, as is generally assumed, upon the

* Journal of the Royal Asiatic Society, Ceylon Branch, 1853, p. 89.

† Hartshorne, *l. c.*

‡ The Mahávaṉso, edited by George Turnour. Ceylon, 1837, vol. I., Index and Glossary, p. 30.

north-west coast, not far from Puttaḷam,* he found an already organised Yakkho state :† indeed, it is related of Gotama Buddha himself that he came to Laṅká,‡ a settlement of the Yakkhos. It would hardly be allowable to conclude from this, with Sir Emerson Tennent§ and others, that the people of the north-west coast, to whom the name of Yakkhos was given, were identical with the present Vęddás, and that up to the time of Wijayo an aboriginal homogeneous race inhabited the Island ; but it may not be a mistake to assume that in the earliest period almost the entire population were devoted to this *yakkho* worship, as it now exists among the Vęddás, and is to be found only among them ; for the Siṇhalese are Buddhists, the Moors and the greater number of the Tamils being Muhammadans.

One fact also speaks against the whole Island having been inhabited by Vęddás : that the legends tell of kings, princesses, and cities (for instance, Laṅkápura) of the Yakkhos, whilst no trace of all these is to be found among the Vęddás of modern times. As they have no God, no priests, no temple, so they make shift to get on without a king, without chiefs, and without cities, even without houses. At least this is true of the wilder portion of them. We should have to assume such deep degeneration of the present Vęddás, from the old Yakkho times, as would be without a parallel in history as well as in ethnology. Even for those who, like myself, acknowledge the possibility of a deep mental and physical degradation of whole tribes, it would yet be going very far to admit that a tribe which

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* Mr. Brodie (Journal Royal Asiatic Society, Ceylon Branch, 1853, p. 48) states that the place where the first settlement was made (Tambapanni), now called Tammena Aḍaviya, lies about six or eight English miles east of Puttaḷam. The word Tambapanni is derived from the Greek name for the Island, Taprobane. Tennent, *l. c.*, vol. I., p. 525, note I.

† Maháwaṇso, pp. 48, 49.

‡ *Id.*, p. 2. Laṅká filled by Yakkhos, and therefore the settlement of the Yakkhos. Laṅká is an old name of Ceylon.

§ Tennent, *l. c.*, II., p. 438.

had never changed its ground, and was living in the immediate vicinity of comparatively highly civilised tribes, could in a little more than two thousand years have sunk so low. Farther accounts will certainly prove that the question of the deterioration of the Veḍdás is not to be evaded; but I must here declare that I cannot bring myself to admit their possible decline from an organised Yakkho state.

Not a single fact sustains the conjecture that Wijayo, with his followers from the Valley of the Ganges, was the first stranger who came to Ceylon. On the contrary, the legend of the advent of Gotama Buddha clearly points to earlier arrivals. This is done no less by the old traditions of the Rámáyaṇa. Lassen* declared outright that in the legend of Ráma we must see the reminiscence of a former attempt to colonise this Island by immigrants from India. The north-west coast of Ceylon lies so near the coast of Coromandel, and the vicinity of Adam's Bridge having always been (then as well as later) the landing place for intruders from Hindústán, it would be astonishing if the first immigration at such a remote period should immediately have become a fixed fact in history. If Wijayo found some kind of political organisation on the Island, we may assume that before him there had been an invasion of other tribes, and the time in which the whole north of the great Island was Veḍdá land must then be placed a good deal further back. In historic times one irruption after another from the north and west occurred, and the aborigines were driven toward the south and east. But of these aborigines we must say that only a part of them have preserved in its purity the original type.

The first visit of Gotama Buddha to the Island was, according to the Maháwaṇso,† at Mahiyangana. This place, to be sure, is found right in the present Veḍdá land near Bintẹnna,

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* Christian Lassen. Indische Alterthumskünde. Bonn, 1847. Bd. I. S., 198.
† Maháwaṇso, p. 3, cap. I.; Introduction, p. xxiv; Glossary, p. 16.

where afterward the kings Devánampiyatissa (307 B.C.) and Duṭugẹmuṇu (164 B.C.) had erected a dágaba.* According to the Yakkhos, in whose midst the Buddha here appeared, he visited on a second occasion "Nágadípo," the abode of the Nágas, or snake-worshippers,† which is generally assumed to be the name for the north and west of the Island; at any rate, mention is made of Nágas living by the ocean, as well as mountain Nágas: there is a Nága king of Kẹlaniya spoken of in the neighbourhood of Colombo. Sir E. Tennent‡ compares this idol worship to that of the Rákshas among the Dravidian tribes of Hindústán, and probably with much correctness, but he overlooks the fact that if any importance is to be attached to these mythological traditions, a multitude of tribes, or at least a division of the original population, must be inferred. And it is not without value that the description of the Nága states in these most ancient myths discloses to us the picture of a much more perfect organisation than we find any account of in the tales of the Yakkhos. Nevertheless, we must renounce the idea of using these myths as the basis for ethnological contemplation and for building up a highly developed Vẹddá state in pre-historic times. If the Vẹddás of Bintẹnna were Buddhists before the time of Wijayo, the later absence of all religion among them, their preference for animal food, and many other things, are scarcely explicable.

Up to a very recent date the Vẹddás have been a nomadic, half cave-inhabiting race of hunters. As already said a small number of them lived upon a proportionally vast tract of woodland, which without exact boundaries, but under the recognition of a kind of traditional family claim, was distributed among little groups of relations, who clung together. Each family had its special hunting-ground, to which its prerogative was acknowledged. Within this they

* Tennent, *l. c.*, II., p. 420. † Maháwaṇso, p. 4.; Glossary, p. 18.
‡ Tennent, *l. c.*, I., p. 328.

sought honey and bees'-wax, dug edible roots, chased the game, and laid their snares for birds or fishes. Of any kind of culture, be it of garden or farm, there was no trace. They had no tame domestic animals, except the dog; and it may be questioned whether even this was not a later adoption, for according to Bailey* the species differs in no wise from the race common in Ceylon. Moreover, the dogs seem to have been trained to be watchdogs, and not for the chase.†

Sir John Lubbock‡ lays much weight upon their possessing hunting buffaloes, which were so well trained that the hunter guided them by a rope slung round one horn, whilst he himself, concealed behind them, crept up to the game. But Mr. Bailey§ says expressly that this practice, which he certainly had observed in Bintenna, extended all over the Island: we therefore can hardly concede to the Veddás a claim to this invention.

Their hunting utensils are the simplest possible. They consist of a strong bow, six feet long, and from two to three arrows, three feet and a half long, whose points are of wrought iron. All the writers describe the bending of this bow as very difficult. Sir E. Tennent‖ describes the Veddás in a half-lying position, using the left foot to draw the bow, and gives a picture of one, according to a model carved in ebony, by one of the native wood-carvers. More recent reporters find no trace of the continuance of such a practice; they describe the bow as being drawn with the left arm, and attribute the extraordinary power and development of this arm to this practice.

Besides iron arrow-heads the Veddás had one iron axe—sometimes, though rarely, two, a larger and a smaller one

* Bailey, *l. c.*, p. 286.

† Davy (*l. c.*, p. 117) says plainly, they do not use dogs for the chase, unless perhaps at *talagoyá* (iguana).

‡ John Lubbock. Pre-historic Times. London, 1878, 4th edition, p. 448.

§ Bailey, *l. c.*, p. 288.

‖ Tennent, *l. c.*, vol. I., p. 499; Note 7, vol. II., p. 439.

—principally for the purpose of cutting wax and honey out of hollow trees. These tools they obtained by barter with their neighbours. Their only achievement is shaping the arrow-heads for special uses by pounding them. But even these poor specimens of work are rare, and preserved in the family as precious heirlooms; sometimes, indeed, they make arrow-points simply of sharpened wood, ornamented with feathers of birds. Mr. Hartshorne* makes the interesting statement in connection with these facts, that the word *galrekki*, by which they denote the axe, is connected with the Siṇhalese *gala*, "stone" or "rock," and rightly finds in this a reminiscence of an earlier period, when stone weapons were in use among the Veddás. I am not, indeed, aware that utensils of stone have been found in Ceylon, but on the other hand I do not know that they have ever been sought for there. It would perhaps be a not unprofitable task to explore those caverns thoroughly in the hope of finding other contents, where, according to Mr. Bailey, bones of the dead are still to be found.

They subsist almost wholly on animal food. Like the Buddhists, excluding the flesh of cattle, and also (according to Sir Emerson Tennent and Mr. Bailey) that of the elephant, bear, leopard, jackal, and fowls. They eat, however, the flesh of all other birds, of the Ceylon elk (samba, *Rusa Aristotelis)*, deer *(Axis maculata)*, monkeys, pigs, iguana, and pengolin *(Manis pentadactylos)*—the last being considered the best: among fishes they prefer the eel.† All their food is cooked; as, however, they have no clay or earthen vessels, the preparation of the meat is very rough. Wolf‡ even asserted they ate the meat uncooked. At present this does not seem to be the rule; they now boil and roast their

* Hartshorne, *l. c.*, p. 408.

† In the choice of their food both classes (rock Veddás and village Veddás) are almost omnivorous, no carrion or vermin being too repulsive for their appetite. Tennent, II., p. 439. "Their food being only flesh." Knox, p. 61.

‡ Wolf, p. 117.

meat. They strike fire in the usual way in the East, by placing one pointed stick against the concave of another piece of wood, which they hold between the feet and whirl round rapidly.* For this purpose they use the wood of the same tree from which their bows are made—the *velanga* tree *(Pterospermum suberifolium)*.

It would seem, however, that of late this custom of fire-rubbing had gone out of use ; at least Mr. Hartshorne asserts that they now use flint and the steel of their axes or arrow-points for the purpose.

The use of any special stimulant is unknown among them ; they have neither betel nor tobacco.† They drink only water, and chew a kind of bark. Even salt was unknown to them, as Mr. Hartshorne‡ informs us ; but when it was given them they were much delighted with it.

Only in single places, where European influence is perceptible, do we find a rude kind of agriculture, such as is seen at the present day in Spain and in the Troas. Little strips of the jungle are burnt down and tilled ("chena"), and then again let alone for five, ten, fifteen years§ ; with this exception, which really cannot be taken into account, their whole existence depends upon the products of the chase. The universal recognition of this appears in their name, which, according to the almost unanimous application of the word, signifies "hunter," "archer," "one who shoots." I shall return to this later. For the present I would only lay stress on the fact that in the customs of the Veddás there is nothing to speak of which indicates that anywhere, or at any time, they have risen above the condition of a savage tribe of hunters.

Indeed, they have never arrived at even the very crudest

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* A detailed description by Sir E. Tennent, *l. c.*, II., p. 451.

† In the illustration by Knox the Veddá is represented with a lighted pipe, but this was an unwarranted addition by the artist.

‡ Hartshorne, *l. c.*, p. 413.

§ Bailey, *l. c.*, p. 282.

form of permanent dwelling places,* although they sheltered themselves from the inclemency of the weather in the natural caverns of the country, or in simple huts† made of branches of trees and bark put together: they seem never to have made these their settled abodes.

On the contrary, perpetual change of place within their hunting grounds was ever the rule. Hence their social intercourse, indeed their circle of interests, is essentially limited to their nearest of kin, whose number is often very small, consisting, perhaps, of only four or five persons. All stimulant to higher requisitions and enjoyments is therefore wanting. Ambition, jealousy, love of finery, cannot thrive among them ; nor, on the other hand, does the need of any sustained mental effort appear. Thus, as it seems to me, may the natural explanation be found of a list of peculiarities ; indeed, also, in part of contradictory oddities.

From such a wild and inferior race of people one might perhaps expect that they would assault strangers, menace their neighbours, and live in a state of war with the more remote portions of the tribe. But, setting aside some very old tales and records of individual cases, which may be wholly disregarded, the habits of the Vẹddás are thoroughly peaceable. They have never even made the step from hunter to warrior. They are peaceable among themselves and towards others, so long as they are unmolested. They

* Knox (*l. c.*, pp. 61, 62) says of them:—"They have no towns nor houses, only live by the waters under a tree, with some boughs cut and laid round about them, to give notice when any wild beasts come near, which they may hear by their rustling and trampling upon them." He saw such places on his flight from an almost twenty years' imprisonment.

† Sir E. Tennent, *l. c.*, II., p. 439, speaks also of this, and that they sometimes slept upon stagings which they prepared in the trees. This would demonstrate habits like those to which Mr. F. Jagor calls attention in his account of the Kanikars in Hindústán. (Zuitf. Ethnologie, 1879. Verhandh. der Berlin Anthrop. Gesellsch, s. 79, Tat. 9.) On the other hand, Mr. Hartshorne asserts they are bad climbers, and possess no special capacity for catching hold with the feet. Percival (*l. c.*, pp. 284, 285) asserts on the other hand that they climb trees with the greatest expertness and celerity, and sleep on them or at their feet.

respect the rights of property, and are true, and, further, loving. In proportion as their life is limited to the circle of the family, family feeling is more strongly developed. Adultery and polygamy are mentioned* only where attempts have been made to civilise them, whilst among their neighbours, the Siṇhalese Kandyans, adultery and polyandry† were so common that the English Government was obliged to issue a special law for prevention. Conjugal fidelity and monogamy, as well as love for their children, were matters of course among the Vẹddás. Mr. Bailey‡ quotes the very characteristic remark of a Kandyan about them, that "they are just like wanduroos" (monkeys); and yet the women are far from being attractive, are not conspicuous by their ornaments, nor even cleanly. "They are the most ordinary specimens of the sex I ever saw," says Bailey.§ Both sexes go almost naked. In former times they wore pieces of the bark of the *riṭi* tree (*Antiaris innoxia*, or *A. saccadora*); these were later replaced by little bits of cloth, which were held fast around the body by a string. The women were distinguished by wearing round ivory pegs stuck through their ears. Mr. Hartshorne,‖ however, saw ornaments worn in the ears by both sexes—generally pearls, or what seemed peculiarly admired, empty cartridge-boxes. Evidently these are quite modern innovations; and we may without hesitation assume that, up to a comparatively recent date, perfect, unadorned nakedness was the rule, modified at the most only by a slight covering of the pudenda.

If nevertheless neither polygamy nor polyandry has been observed among them, this may be explained by the isolation of families, and the great distances which separated them; perhaps, we can in the same way also account for the other very peculiar custom among them, which has been testified

* Gillings, *l. c.*, p. 86.
† Tennent, *l. c.*, II., p. 428.
‡ Bailey, *l. c.*, p. 293.
§ Bailey, p. 284.
‖ Hartshorne, p. 409.

to by various travellers, viz., that of marriage with a sister. It was only with a younger sister, marriage with the elder being considered unchaste. According to Mr. Hartshorne,* even marriage with a daughter was allowed, although probably this, if it occurred, as a matter of fact was not legitimated. Knox † also tells of a king of Kandy who had a child by his daughter, but none of his subjects seem to have considered this a proper relation. Bailey‡ is inclined to see in this marriage with the sister a last remnant of times outlived. This reminds us that Wijayo, the founder of the Sinhalese dynasty, sprung from marriage in India with a sister, and that his son again, Jívahattha, whom he had begotten with a Yakkho princess in Ceylon, had married his sister, and was the progenitor of a special tribe, the Pulinda. Later, this practice was also in use among the royal families of the Sinhalese.§ We must allow that these statements are certainly worthy of attention, but these old myths are hardly to be looked upon as positive historical facts. They seem to me only to prove that a practice which existed also in Persia and Egypt, was early permitted in Ceylon ; the reason for it was probably the same everywhere, in the royal families as with the naked Veddás, the lack of suitable women, or of women altogether. At any rate, it is not unchastity or licence which leads the Veddás to form such marriage ties. A marriage among them is usually decided by the will of the parents of the bride, who herself is allowed no choice ; the only ceremony consists in the bringing of food for the parents on the part of the suitor. If under these circumstances the matrimonial tie is held faithfully and truly, it surely speaks for the purity of heart in such a wild race.

On the other hand we perceive from the accounts of different observers, that there is no particular depth of feeling among the Veddás ; all the descriptions indicate rather a

* Hartshorne, *l. c.*, p. 416. † Knox, *l. c.*, p. 38. ‡ Bailey, *l. c.*, p. 310.

§ Sir E. Tennent (II., p. 459) quotes as authority for this, Valentyn, *l. c.*, cap. IV., p. 63.

certain morose indolence, which is only occasionally broken through by their love of habit. Most noticeable in this connection is an observation of Mr. Hartshorne's,* which he corroborates by a series of instances. I refer to the incapacity of the Veddás to laugh. Whilst they can help they not only do not laugh themselves, but despise those who do. As far as my knowledge goes, nothing like this has been told of any other race of people; only among certain idiots has this peculiarity appeared.

In point of intellect Veddás seem indeed to stand very low.

According to Mr. Hartshorne† they are wholly unable to count, have no numerical words, and do not even use their fingers for the purpose. Mr. Bailey‡ does not go quite so far; he says they count with difficulty on their fingers, but he gives no numerals in their vocabulary, and relates how hard it is to make a Veddá understand anything which extends beyond the very next day. The Rev. Mr. Gillings§ says they could count only to a very limited extent. Davy‖

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* Hartshorne, *l. c.*, p. 410.

† Hartshorne, p. 413. "They are wholly unable to count or to comprehend the ideas of one, or two, or three, nor do they even use their fingers for this purpose; and the chief difficulty in obtaining any information from them arose from their inability to form any but the most simple mental synthesis, and from their very defective power of memory." On another occasion Mr. Hartshorne even asserts the Veddás had no idea of the distinction between one and two. (Journal of the Anthropological Institute of Great Britain and Ireland, 1878, vol. VII., p. 468.)

‡ Bailey, *l. c.*, p. 298.

§ Gillings, *l. c.*, p. 88.

‖ Davy, *l. c.*, p. 118. In this place the "Village Veddás" are spoken of. Pritchard (Researches into the Physical History of Mankind. London, 1844, 3rd edition, vol. IV., p. 193), who says the same, reports that the description of Dr. Davy refers to a large "party" of Veddás whom he saw during his visit to Kandy. According to their own account these people had come from the neighbourhood of the Lake of Bintenna, where "a little grain" was cultivated. I do not doubt the correctness of this communication, which is of great importance for a true estimate of the statement regarding the intellectual capacities of the people. But it is taken from a work of Dr. Davy's not accessible to me. Prichard cites it under the title: "History of the Island of Ceylon." In the "Account of the Interior of Ceylon" no reference is made to it, although the visit to Kandy is very circumstantially described (p. 364, sq.).

asserts they have hardly any knowledge of numbers, and cannot count beyond five. Sir E. Tennent* goes a little step further in saying they are incapable of counting over five on their fingers. Even this is after all very little, especially when we realise that these milder statements refer to the "tamer sort." Mr. Hartshorne† also contends that their language includes no word designating colour; that they have neither a fancy for bright colours nor any sense of the distinction in colours.

Finally, he complains of their defective power of memory, and their inability to form any general ideas. Sir E. Tennent says they have no notion of time or space, no words for hours, days, or years—no games—no amusements—no music. These statements, however, in their full breadth apply only to the "wild sort" of the village Veḍdás. Davy‡ says that they have a rough kind of song, performed as an accompaniment to a very clumsily executed dance. When we add to all this the fruitlessness of any and every attempt to educate them, we are compelled to acknowledge the inferiority of the race. Even granting some of the observations furnished are too exclusive, it would not alter the general opinion.

It looks like a contradiction that, as Mr. Hartshorne§ informs us, they consider themselves as superior to their neighbours. This sort of contradiction is not limited to the Veḍdás—narrow-minded people not unfrequently over-value their capacities. But it does sound very strange when the different reporters state that the Veḍdás are looked upon even by their neighbours as members of a high—yes—of a regal caste. They are said to have been allowed in earlier times to speak of the king of Kandy as "*Húrá*," which means "cousin." As among themselves they know of no distinction of caste, this is indeed very striking. It has even been regarded as an evidence of the correctness of the tradition that they are

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* Tennent, *l. c.* II., p. 443.

† Hartshorne, *l. c.*, p. 409.

‡ Davy, *l. c.*, p. 118.

§ Hartshorne, p. 412.

of royal blood, or even as Mr. Bailey* assumes, descended straight from King Wijaya himself; but where then is the posterity of those Yakkho people to be found whom Wijaya met upon his arrival on the Island? It is not possible to bring any of the other numerous races represented in Ceylon into a nearer connection with this aboriginal population.

The earliest reporters who have spoken at any length on this subject of caste in the Island, all concur in declaring that the Veddás were counted as members of a higher caste.

Davy,† who enters most minutely into this matter, says that the majority of the Sinhalese were assigned to the agricultural caste, to the so-called "Goyivaṇsé," or, as it is styled in the lowlands, "Vellála," and that to this caste also the Veddás belonged. Philalethes‡ makes the same statement. He explains the word *Govi* to be Sinhalese, and the word *Vellála*, Malabar; to this caste belonged, according to him, the Vanni Veddás, and he speaks of two sorts—one wearing leaves upon their bodies, the other using the bark of a tree made soft by special preparation. That the later observers touch less upon this subject is explained from the circumstance that in recent times the distinction of caste has lost much of its significance among the Sinhalese, who even in earlier times left the two highest castes, the Royal and the Brahmin, without representatives. Perhaps this circumstance also explains the peculiar usages by which the Veddás, who really belong only to the third general caste, have been brought into connection with the kings themselves. As late as the year 1853, the secretary of the Ceylon Branch of the Asiatic Society remarks in a note§ that the Veddás of Bintenna and of the sea coast consider themselves members

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* Bailey, *l. c.*, p. 312. † Davy, *l. c.*, pp. 112–15.

‡ Philalethes, *l. c.*, p. 332. The name Philalethes is a pseudonym, as Sir E. Tennent presumes (*l. c.*, Introduction, p. xx., note 5), to conceal that of the Rev. G. Bisset. This gentleman was in Ceylon at the same time with Dr. Davy, who mentions him personally, *l. c.*, p. 372, sq.

§ Journal of the Ceylon Branch of the Royal Asiatic Society, 1853, p. 89.

of a very high caste, and call themselves Vẹddá Vellálas. From these communications we see clearly that the designation "Vellâla," which we find also in Hindústán, has only a hierarchical meaning, but is of no help at all toward the discovery of the relationship and derivation of the tribe.

Another name here requires particular mention, as it is liable to introduce confusion. It is the name "Daḍa Vẹddás," which is given to a division of the Ṣudra (Kshudra) caste, that being one of the very lowest classes: hunters dwelling in the wildest parts of the mountain region.*

Knox † says the lowest of the low are beggars, who are the descendants of the "*Dodda Vaddahs*, which signifies hunters;" it had been their task to provide game for the King of Kandy. When, however, instead of venison they brought him human flesh, the king had them thrust out, and given over to beggary. The detailed description which he gives of them shows that he means one of the outcasts. Davy cites two kinds of them: the Gattaru and the Roḍiyas, or Gasmandó, whom he compares with the gypsies. The latter are now usually called Roḍiyas. Of them Sir Emerson Tennent ‡ relates the same story that Knox tells of the Daḍa Vẹddás, adding that a legend declares them to be a branch of the Vẹddás. A still more minute description of them has been furnished by Mr. Casie Chetty. § He calls them a peculiar and distinctive race, either descendants from a colony of wandering hordes out of India, or the last remnants of an aboriginal population mixed with Siṇhalese women of high caste, who had been punished by the king with loss of caste. They live, he goes on to say, in the interior, not great in numbers,—perhaps, in all, not above one thousand,—scattered, or in special detached villages (*kuppáyam*). In the Seven Kóralés two divisions are distinguished: the *Tiringa Roḍi* and the *Halpagé Roḍi*.

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* Davy, *l. c.*, pp. 112-27. Philalethes, *l. c.*, p. 334.

† Knox, *l. c.*, p. 70. ‡ Tennent, *l. c.*, II., p. 187.

§ Simon Casie Chetty. Journal of the Ceylon Branch of the Royal Asiatic Society, 1853, p. 171.

They are more robust and athletic than the Siṇhalese, and the women frequently pretty. Both sexes allow the hair to grow its full length, and wind it into a coil. They live by the chase, and use bows and arrows like the Vẹddás; like them also they wrap their dead in mats and bury them. Although Buddhists they offer sacrifices to the *Gará Yaká* and to the *Vẹdi Yakku.* They speak Siṇhalese, but have some peculiar words, which Mr. Chetty thinks remnants of past ages. The description by Sir E. Tennent agrees with this. He visited a Roḍiya village, which lies on the pass between Kandy and the Mahawẹli-gaṇga, and gives a picture of a group of these people. He proves that the Roḍiyas were mentioned in the *Rájáwaliya* as early as 204 B.C., and in the *Maháwaṇso* 589 A.D.

According to his opinion they differ physically very much from the Vẹddás, and he is inclined to believe they had their origin on the coast of India, and belong to the Chaṇḍálas. For the rest they are only found in the Districts of Kandy. Although they may be compared to the Cagots and Caqueux of the Pyrenees, there are yet two races of outcasts in Ceylon, who were detested even by the Roḍiyas, namely, the *Ẹmbẹṭṭáyó* (barbers) and the *Hanomoreyó* (betelbox-makers) in Uva.

The existence of these outcasts is of no little importance to us in explaining the position of the Vẹddás among these complicated tribal relations. Had the Vẹddás, as many have surmised, been originally outcasts, they would surely have remained so to this day, just as the Roḍiyas have been for at least two thousand years. If they had, like the Arabs, the so-called "Moormen," subsequently emigrated, they would not be placed in the relatively high caste of Vellála, for the Moormen are in no caste, although attached to the Karáwé (fishermen), a subdivision of the Ṣudras. Unquestionably, then, the Siṇhalese must have retained a feeling of the original connection, which in spite of the religious and physical dissimilarities made them acknowledge the Vẹddás

as belonging to the social order of the Buddhists. Thousands of years had not sufficed to reduce the Roḍiyas to that degree of degradation to which the Vẹddás had fallen when Knox heard of them, and which is most strongly expressed in the words of Davy,* who says of the forest Vẹddás that they are "rather solitary animals than social, and resembling more beasts of prey in their habits than men." We shall yet see what objections there are to our regarding the Vẹddás simply as "wild Siṇhalese," and how it has happened that a great number of direct observers have thought to find their origin on the coast of Malabar. This point will be more appropriately treated of later, and after we have considered the physical peculiarities of the different tribes under discussion. It here seems in place first to bring forward the historical and linguistic observations which concern the relations of the cultivated tribes of the Island.

The natural territory for immigrants is, as aforesaid, the north-west part of the Island, which lies nearest to the peninsula of Hindústán. Here a Tamil population is established, whose connection with the Dravidian of India seems unquestionable. In the history of Ceylon we find very early mention of inroads by the Dravidian hordes. In the *Mahá-waṇso* these people are called "Damilos." Since according to the testimony of the trustworthy Childers,† the word *Damiḷa* is in the Páli identical with *Dravida* in the Sanskrit, we may without hesitation apply to the Dravidians whatever is said of the Damilos in the *Maháwaṇso*. The English local writers generally call them Tamils or Malabars. Sir E. Tennent,‡ however, repeatedly warns us against understanding this to mean only the inhabitants of the actual Malabar coast. On the contrary, they belonged to one of the earliest organised states in the south of India, to the kingdom of Páṇḍiya,

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* Davy, *l. c.*, p. 116.

† R. C. Childers' Notes on the Siṇhalese Language. Journal of the Royal Asiatic Society. London, 1875, vol. VIII., p. 133, note.

‡ Tennent, *l. c.*, I., pp. 353-94.

which embraced the largest part of the Coromandel coast as far as Canara on the west coast, and south down to the sea, and of which at present there remains only the little State of Madura. Later on, hordes bearing also the name of Malabars poured over the Island from all parts of the peninsula, and also from the Coromandel coast as far as to the north of Cuttack and Orissa.

As early as the year 237 B.C. an invasion of the Damilos in the north is mentioned, where they established a sovereignty lasting twenty-two years.* Scarcely were they vanquished when, under the next king of the Síhala dynasty, Aséla (about 215 B.C.), again a Damilo, of the tribe of Uja in the Chóḷa-land,† usurped the throne‡ and ruled forty-four years. Although regularly defeated the Damilos ever anew repeated their invasions. In the reign of the king Mihinda (1023–1054 A.D.) the foreign population in the Island had increased to such an extent that they overpowered the aborigines, and upon a new invasion of the people from Solí the king was taken prisoner, and the country for a long time held under subjection.§ From Malabar fresh hordes continually streamed in, and only after severe struggles was the foreign yoke thrown off. But in the beginning of the thirteenth century the Chóḷas invaded the land again.‖ This time, however, the conquerors came from much more distant places, namely, from Káliṅga, and from the part of the Dekkan now called the Northern Circars.¶ Their leader, Mágha, subjected and cruelly devastated the whole country from north to south, and became king of Ceylon in 1211 A.D. Later, the Siṅhalese prince succeeded in winning back again the provinces of

* The Maháwaṅso, chap. XXI., edited by Turnour, p. 127. In the same book comp. Appendix : Sovereigns of Ceylon, p. lxi.

† According to Turnour, Maháwaṅso, Glossary, p. 5, the Siṅhalese *Solí* is called Chóla, and probably embraces Mysore and Tanjore.

‡ Maháwaṅso, p. 128.

§ Maháwaṅso, chap. LXIV.

‖ A. De Silva Ekanáyaka. Journal of the Royal Asiatic Society, 1876, vol. VIII., p. 297.

¶ Tennent, *l. c.*, I., p. 412.

Ruhuna in the south and Máyá-raṭa in the mountainous centre of the Island; but the north of the country, the province of Pihiṭi or Rája-raṭa, the old land of the kings, remained, even as far as the Mahawęli-gaŋga, in the hands of the Tamils, and was by degrees wholly and permanently Dravidised. Only a part of this population, the Mukwás,* who dwell on the north-west coast, northward from Chilaw, have accepted the Christian religion.†

In the same way, although in a more peaceable manner, came into the country numerous Muhammadan Arabs, who since the time of the Portuguese have been called "Moors" or "Moormen."‡ Sir A. Johnston places their arrival in the early part of the eighth century, and traces their descent from the house of Hashim, whose members were driven from Arabia by the Calif Abdul Melek ben Merwán, and settled in Southern India, Ceylon, and Malacca. But the careful investigations of Sir E. Tennent§ have furnished evidence that the settlements of the Arabs in the Island were of much earlier date. Even when we set aside a very dark passage in Pliny, still there seems to be no doubt that at least since the first, or surely since the sixth century A.D., very extensive mercantile relations existed between Persia and Arabia and Ceylon, and that since that time many of these "Mauren" (as the Portuguese called them later) remained in the land. Sir E. Tennent considers the present Moors descended from the immigrants who intermarried with the natives. Mr. Pridham|| divides the Moors genealogically into two groups: one he traces back to the old Arabian immigrants, who took to themselves

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* A similar word (Mokna) is used in Madagascar to designate immigrant Africans. (Verhandl. der Berlin. Anthropological Societät, 1880, s. 190. Zuitf. Enthnolo. Bd. 12.) Here a Negro tribe is alluded to on the eastern coast of Africa that bears this name. (Monatsbere der Academie, 1880, s. 1017.) Possibly the coincidence in the name is a mere accident.

† A. O. Brodie, Journal of the Ceylon Branch of the Royal Asiatic Society, 1853, p. 50.

‡ *Id.*, p. 40.

§ Tennent, *l. c.*, I., pp. 546, 555, 607.

|| Pridham, *l. c.*, I., p. 470.

wives from among the natives, and begot children by them; of the other, whom he calls Indo-Moors, who in greater numbers are said to have later settled in the districts of Chilaw and Puttaḷam, he gives no generic explanation, only contradicting the opinions of Mr. Cassie Chetty, that they derive their origin from a mixture of an aboriginal Hindústání population, the Sonahars, with Arabs and other Muhammadans. At any rate, however, Mr. Pridham acknowledges that no distinction any longer exists between the two groups. They are now in separate villages, portions of them scattered about over the whole Island, and are the chief medium of all mercantile intercourse, even with the Veḍdás.

Malays belonging throughout to the Muhammadan religion are to be found in the Island only in comparatively small numbers, but scattered over many regions. According to the representation of Mr. Pridham,* they are descended chiefly from the little Rájás and their followers, whom the Dutch drove either from Java, Malacca, or Sumatra, and who were later by the English taken into their regiments of natives. More important it would be for us if the opinion were correct that the original population of the Island had been Malays. This is supported by the certainly very noticeable fact that the Siṇhalese used double canoes, or boats with booms, just such as are used in all the regions inhabited or colonised by Malays, that is to the west of the Indian and Arabian coast of Madagascar.† This, however, is the only foothold for the hypothesis of an ethnic relationship.

Naturally in the last centuries the different nations of Europe, especially Dutch, Portuguese, and English, have been added to the population, but for our researches they are of no importance. The same is to be said of the African Negroes and the Parsees, the former of whom have been only recently introduced, whilst the latter immigrated at different periods, but in small numbers.

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* Pridham, *l. c.*, I., p. 482. † Tennent, *l. c.*, I., p. 327; II., p. 103 (engraving).

The southerly half of the Island, the old province of Ruhuna, and the central Máyá-land, are still peopled by the Siŋhalese,* the former by comparatively pure-blooded Siŋhalese, the latter by the somewhat more mixed Kandyans, who have been repeatedly mentioned as the immediate neighbours of the Vẹddás.

The ethnological position of the Siŋhalese has been until now discussed chiefly on linguistic grounds.

Since Rask† their language has been considered as Dravidian; Lassen‡ has sustained this opinion with the whole weight of his authority; he regarded the Siŋhalese people, according to their language, as belonging to the great family of the Dekkan tribe. Still more recently Mr. F. Müller has declared the Siŋhalese language to be an idiom akin to the Dravidian language, strongly mixed with Indian elements, which, however, differing from them genealogically, has therefore had an independent development. Hence he infers the population to be a mixture of immigrated Indians‖ with the aborigines, who seem to be of the same race as the Dravidians. Directly the opposite opinion (and one which of late is more and more generally recognised) has been maintained by d'Alwis¶ and Childers,** both of whom were employed in the civil administration of the Island. Childers, whose thorough knowledge of the Indian languages is universally acknowledged, separates the present Siŋhalese language from the ancient Ẹlu, from which, as he says, it is certainly derived, but from which it also differs through the immense number of Sanskṛit words it includes, partly unchanged, as the English

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* In the writing of this name I follow the explanation of it by Childers, *l. c.*, p. 37 (instead of Singhalese or Cinghalese).

† Rask. Singalesisk Skriftlaere. Kolombo, 1821, (quoted by Lassen).

‡ Christ. Lassen. Indische Alterthumskundl, I., s. 199–303.

§ Fr. Müller. Allgemeine Ethnography. Vien., 1879, s. 466, sq.

‖ Reise der Novara, O. S., 139.

¶ James d'Alwis. On the Origin of the Siŋhalese Language. Journal of the Ceylon Branch of the Royal Asiatic Society, 1867–70.

** Journal of the Royal Asiatic Society. New series. London, 1875, vol. VII., p. 35; 1876, vol. VIII., p. 131.

of to-day differs from the old Anglo-Saxon. According to him the name of *Ẹlu* is identical with the word *Sinhala*, as the Sinhalese call themselves, which borrowed from the Sanskrit is by the uneducated generally pronounced *Hinhala*; it stands for the old word *Hela* or *Helu*, and this again for a still older *Sela*, which leads us back to the Páli of *Síhala*. The old tradition, according to which the founder of the Síhala dynasty (Wijaya) came from Lāḷa, a district of Magadha (Behar) in India, agrees very well with the fact that according to another tradition Páli was originally a Magadha dialect. Páli and Sinhalese are so nearly related that one might almost believe at the first glance the latter to be derived from the former, but on closer inspection we should see that Páli, in which the teachings of Buddha were written, represents only the dialect of one district of Magadha. Hence Sinhalese is one of the native Aryan (Sanskrit) languages of India, and very ancient. For it is absolutely identical with the Ẹlu of the fifth and sixth centuries A.C., which is found also on the rock inscriptions of Mihintalé of the second or third century. The early establishment of the language is explained by the fact that Mahinda, at the beginning of the third century B.C., translated a Buddhist work from the Páli into the Sinhalese, thereby making the latter the written language.

What place the Vẹddá language holds relatively to this is still in the highest degree dubious. In Ceylon itself the opinion has long prevailed* that it is a broken or corrupted Sinhalese. Mr. Bailey† also adopted this opinion, although he considers the Vẹddás as descendants from an ancient Tamil population. But he found in their language numerous Hindú words—personal names—corresponding often to the names of Hindú gods or goddesses. Hence he was inclined to assume an

* Knox, *l. c.*, p. 104. Mr. Justice Starke, Journal of the Ceylon Branch of the Royal Asiatic Society, 1853, p. 80. Gillings, *id.*, p. 84.

† Bailey, *l. c.*, pp. 297, 305, 309. He mentions especially that the so-called elk of Ceylon (*Rusa Aristotelis*) is in Vẹddá language called "gawra," which reminds one of the gaur (*Bos gaurus*) of Hindústán. But to be sure the pengolin (*Manis pentadactylos*) is also called "gal gawra."

early mixture of the Vẹddás with the Sanskrit-speaking people of India. Mr. Max Müller* confirms the frequency of Sanskrit words in the Vẹddá language ; more than half the Vẹddá words, according to him, are, as in the Siṇhalese itself, mere corruptions of the Sanskrit. Mr. E. Tylor† also, who considers the Siṇhalese an Aryan tongue, holds the Vẹddá language for a Siṇhalese dialect, although with a mixture of Dravidian (Telugu) words. Therefore he finds a striking contradiction in that probably a non-Aryan, aboriginal tribe speaks an Aryan language. This he calls a perfectly unique instance in ethnology. Later on he repeats his thesis in the following words : "Their legends as well as their language make a mixture of Aryan blood along with Aryan language probable ; whilst bodily characteristics show that the race of Vẹddá belong chiefly to the native pre-Aryan type.

Mr. Hartshorne‡ has again recently asserted, in direct opposition to Mr. Tylor, the entire absence of a distinct Dravidian element in the Vẹddá language, and allows in it only approaches to the Siṇhalese, to the Páli, and to the Sanskrit. Mr. Cust§ contends for the reverse, objects to the idea of any admixture of Páli or Sanskrit, and holds the

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* Max Müller. Address to the First Meeting of the Aryan Section of the Oriental Congress of 1874, cited by Childers, *l. c.*, vol. 8., p. 131, note.

† Journal of the Ethnological Society of London, 1870. New series, vol. 2, p. 96.

‡ Hartshorne, *l. c.*, p. 417. "Besides the words which indicate an affinity with Siṇhalese, there are others which are allied with Páli and with Sanscrit, and an important residue of doubtful origin ; but it is worthy of remark that from beginning to end the vocabulary is characterised by an absence of any distinctly Dravidian element, and that it appears to bear no resemblance whatever to the language spoken by the Yakkas of the East Nipal. A similarity may, indeed, be traced here and there between a Wedda word and the equivalent for the same idea in modern Tamil, Malayalam, or Telugu ; but the cases in which comparison is possible are so rare, that these apparent coincidences may be fairly considered to be merely fortuitous."

§ R. Cust. A Sketch of the Modern Languages of East India. London, 1878, p. 63.

Veddá language to be simply a dialect of the Sinhalese, which he, like the other writers, looks upon as an Aryan language.

With these disagreements in the views of linguists, we gain, unfortunately, very little from them towards a just comprehension of the phylogenetic position of the Veddás. On the contrary, the mystery that envelops this people, so remarkable in themselves, is vastly increased, and the purely anthropological interest comes even more into the foreground.

So far as we at present know, this people, like so many others, bears a name ascribed to them by outsiders. Mr. Hartshorne only, in a communication made by him to Childers,* asserts that they gave themselves this name (pronounced Vaeddá). The reports generally say just the contrary. The designation Veddá or something like it (Vedda, Veda, Vedan, Vaidan, Beda, Bedan, &c.), is widely used in India, as Mr. F. Jagor† has lately shown by a comprehensive grouping of facts. A whole series of little tribes dwelling far apart, and probably not having the least connection with another, bear this very same name, or one quite like it. The translator of Percival's work, Bergk,‡ reminds us that there are Veddás even in Sumatra and Borneo. At any rate, whether that word is derived from the Sanskrit (*Vyádha*, "hunter") or the Tamil (*Védan*, "hunter," "wood-dweller"), so much seems to be certain, that except where it is used in combination, as, for instance, in the earlier mentioned Dada-Veddá, it always relates to aborigines or savage races. In so far it stands, as Mr. Bailey§ remarks in a paragraph, with the purely literary words "Habara" (barbarian) and "Vannacharakiya" (hunter), and the like. Dr. Max Müller, who declares the

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* Childers, *l. c.*, vol. 8, p. 131.

† Verhandlungen der Berliner anthropologeschen Gesellschaft, 17th Mai, 1879, s. 172. Zeitschr. füw Ethnologie. Bd. XI.

‡ Percival, a. a. O. S., 335.

§ Bailey, *l. c.*, p. 297.

correct writing of it to be Vaeddá, or originally Veadi (Vaediminitta—Vẹddá-people), agrees entirely with the derivation from Vyádhah, and Childers therefore defines the Vẹddás as "wild Siṇhalese."

How long the name has been in use is not yet clearly established. In the works of ancient Occidental writers only one passage has as yet been discovered wherein the Vẹddá name is preserved, although in a mutilated poem. In a work* ascribed, falsely perhaps, to the Bishop Palladius of Helenopolis in Bithynia (defunct 410 A.D.), which describes the journey of a man from Thebes in Egypt to Ceylon, we read *εἰσι δε καὶ οἱ Βιθσάδες ἀνθρωπάρια κολορα, μελανοκέφαλα ἄκαρτα και ἁπλότριχα.*†

Sir E. Tennent,‡ following another edition, reads Βισάδες; but Βιθσάδες is more like the word Vẹddá. Since the further description likewise suits the Vẹddá right well, we may conclude that here the name was for the first time transmitted to the Occident. Before this we only hear that Megasthenes in the time of Alexander knew§ of "Palæogonen" upon the Island, which signifies, according to Sir E. Tennent,‖ "Paliputrá" (sons of Pali); but according to Lassen,¶ referring to the Rákshasas, or giants. In the first case it should apply rather to the Siṇhalese, in the latter to the Vẹddás (though certainly not in the sense of giants). The inland writers do not use the name of Vẹddás until much later.

Mr. Hartshorne,** on the authority of an ancient ola (a book written with a stilus upon palm leaves) which was

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* Παλλαδίου περὶ τῶν τῆς Ινδιας καὶ τῶν Βραγμάνων. Palladius *De gentibus Indiæ et Bragmonibus*. London, 1668, p. 5.

† Tennent gives μεγαλοκέφαλα instead of μελανοκέφαλα, as read in the edition from which I have quoted, although the first perhaps seems more consistent. I must remark that the Latin translation given in the edition of 1668 is *capite nigro*.

‡ Tennent, I., p. 538, note 2; II., p. 438, note 6.

§ Plinius. Natural History. lib. 6., cap. 24.

‖ Tennent, I., p. 529.

¶ Lassen. De Taprobane Insula, p. 9.

** Hartshorne, *l. c.*, p. 414.

in the possession of one of the Kandyan chiefs, states that King Dutugemunu (160 B.C.) appointed the Veddás servants of the god Skanda, in the temple Kataragama Déwále built by him, on account of the purity of their caste. As, however, the age of the ola is not known, we can draw no sure conclusion from this statement. Only the fact that here again the purity of caste is emphasised must make us cautious about looking upon the Veddás as a mixed people. When we consider for how long a time, and with what scrupulous care, the people of India have matured and preserved the distinction of caste, *the fact that they have acknowledged without exception the unity and purity of such a wild tribe* must surely appear of great significance.*

Indeed, all inquirers testify to the unmixed character of the tribe. The different names which have been given to separate divisions do not indicate different tribes, but geographical and topographical distinctions. Thus the Tamils distinguish the "Manalkádu," or sandy jungle Veddás, from the "Cholaikkádu" Veddás, that is, those living on the sea coast, who speak Tamil and till chena land, from those yet leading a nomadic life, who, as they say, are quite different from the others, have preserved much of their original barbarism, and inhabit the more remote parts of the Bintenna district. At any rate, this distinction is not to be understood as referring to typical differences in the tribe.

From the preceding we gather that up to the present time two leading views stand opposed to one another, which are mainly supported by linguistic observations, and only in part by genuine anthropological facts. According to one, the Veddás would be next of kin to the Dravidians; according to the other, members of the great Aryan family. In both cases they must have immigrated from the continent, only in the first very much earlier than in the second. I find only one single conjecture mentioned of any such immigration. The

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* Hartshorne, *l. c.*, p. 406. † *Id.*, *l. c.*, p. 411.

Rev. Mr. Gillings* repeats the story that the Veḍdás originally formed a part of a Siŋhalese community living on the sea coast of India, and that from there they had been transported for certain offences over to the Island at a very early period, and before the Siŋhalese, as a people, had set foot on its shores. But we do not find it said anywhere that such a Siŋhalese community had existed on the Indian coast. Moreover, the Veḍdá language, if any such separation from a common Aryan family had so early taken place, must have retained certain peculiarities belonging to that earlier period of development; and of this also nothing is known.

The explanation should be much simpler, if one might assume that the Veḍdás were originally of the Dravidian race, or at least nearly related to the Dravidians; or even if different from them, at any rate, a savage aboriginal tribe; and that they only received their present language subsequently from their Aryan conquerors. With such an assumption the identity of this language with the Siŋhalese, which is defended by authorities, would be supported without an effort. But it cannot be denied that it is difficult to conceive how the process of Siŋhalesing the language could have been accomplished, whilst their whole way of living, their customs and habits remained wholly unchanged.

In the name chosen by Childers of "Wild Siŋhalese," little is gained. If it means savages with a Siŋhalese language, we have a fact given us, but no explanation. If, on the other hand, it means Siŋhalese who have become savage, we should then, with our explanations, have to fall back on some period after Wijayo, and contrary to all common experience be forced to add the hypothesis (against which I protested in a former passage) that the Veḍdás from a high state of comparative civilisation, such as plainly had once been attained by the Siŋhalese, have sunk to the lowest level of human

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* Journal of the Ceylon Branch of the Royal Asiatic Society, 1853, p. 84.

existence. Religion, political organisation, civil life, all the arts and customs of firmly located tribes have been lost, indeed, forgotten, and that, too, while in closest proximity—even in direct contact—with a people who had passed through a long and eventful history. Such a degradation is not conceivable, unless we can prove at the same time very deep physical demoralisation.

From whatever side we consider the problem, we must always come to the conclusion that linguistics can only be used as aids in the investigation ; and that if a real solution is to be found, it is only possible by means of physical anthropology. What I have to offer in this direction is nowise adequate to lead on to a full solution, but it will perhaps contribute in reducing the possibilities of explanation to a small number, and thus prepare the way for a final decision. At the same time my hope is that these suggestions will stimulate to new labours, especially in the Island itself, that, if possible, even at the last hour every effort shall be made to obtain a correct description of the last remnants of this fast dying out people.

The hitherto ascertained facts regarding the physical peculiarities of the Veddás are the following :—

Even the description of Βιθσαδες (βισάδες) furnishes truly characteristic features. The principal passage has been already quoted : smallness and feebleness of stature, heads black and apparently large, with long, smooth unshorn hair.* Added to this is the further statement that the people dwelling in the rocky caverns are the smallest (πάνυ σμικρότατον καὶ ἀδρανέστατον), and that they are very agile in climbing the precipices.

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* The bad Latin translation of this, which is ascribed to the Holy Ambrosius, in the reprint appended to the above-cited edition of Palladias (S. Ambrosius *De moribus Brachmanorum*, p. 59) : Nam et ipsos exiguos homunculos esse et grandia quaedam capita asserit habere cum levibus et detonsis capillis. Here, therefore, once more is the supposed manner of reading μεγαλοκέφαλα.

Knox, as already cited, saw in his flight through the woods of the Vęddá country no human beings, only empty dwelling places. Hence the picture contained in his book represents a man differing from the likenesses of the Siṇhalese in look only, by his shorter and more thick-set figure ; he wears the hair and beard noticeably long like the Siṇhalese, the former being gathered into a knot on the back of the head.

Percival,* 1798, saw some captive Vęddás in Colombo. According to his representation, they were of lighter complexion than the rest of the Ceylonese, being rather copper coloured, were remarkably well-made, wore long beards, and their hair tucked up close to the crown of the head.

Valentyn† says the Bedas, or Wedas, are a kind of wild bushmen, and the oldest inhabitants of the Island : "Zvort-van berwe, beandend van Oogen, niet groot van gestalte, maar gezeten rad van Lieden." To these very broad statements, followed at last by John Davy‡ the first definite scientific description resting on autopsy. He says : "Such of the village Weddhas that I have seen were in general small men, between 5 ft. 3 in. and 5 ft. 5 in. high, slender, muscular, and well made ; in colour, form, and features resembling the Singhalese. Their appearance was wild in the extreme, and completely savage......Their hair was quite emblematic of their forests : it seemed never to have been cut, or combed, or cleaned ; and was long, bushy, and matted, hanging about their shoulders, and shading their faces in a very luxuriant and disgusting manner ; nor were their beards less neglected."

Sir Emerson Tennent§ gives the following general description of the Vęddás in the region of Bintęnna :—"They all presented the same characteristics of wretchedness and dejection—projecting mouths, prominent teeth, flattened noses, stunted stature, and other evidences of the physical depra-

* Percival, *l. c.*, p. 283. † Valentyn, *l. c.*, bl. 49. ‡ Davy, *l. c.*, p. 116. § Tennent, *l. c.*, II., p. 450.

vity, which is the usual consequence of hunger and ignorance. The children were unsightly objects, entirely naked, with misshapen joints, huge heads, and protuberant stomachs. The women, who were apparently reluctant to appear, were the most repulsive specimens of humanity I have ever seen in any country." Pridham* gives the report of Mr. Bennett, who, during his residence at Hambantoṭa, had two village Veḍḍás brought before him. The latter says of them: "They were not more than 5 ft. 2 in. in height, their hands small, but their feet were long and flat; hair matted and tied in a bunch at the back of the head; a large bushy beard, almost covering the face; eyes small, piercing, and constantly in motion to the right and left, and their ears seemed almost as restless as their eyes."

If from these general descriptions we come to details, we observe that all the accounts agree first in this, that the average stature of the Veḍḍás is small, not to say very small. Dr. Davy (in the citation by Prichard) says of them: "They are well made and muscular, but of a spare habit; and in person they chiefly differ from the Kandyans in the slightness of their limbs, the wildness of their looks, and their savage appearance." Gillings declares: "The Veddahs are mostly low in stature, but some of them are strong, active men, and most of them appear to be healthy, and little subject to disease." The description of Mr. Bailey† is to this effect: "In appearance the Veddahs differ materially from the Singhalese. They are smaller in every respect, and rather dark, or, more properly, more dusky in complexion. They are short, slightly built, yet very active. Though far from being muscular, their limbs are firmly knit together, and they are athletic and capable of enduring great fatigue. Though spare, they are generally in very fair condition, and look more healthy than many of the Singhalese in the adjoin-

* Pridham, *l. c.*, I., p. 460. † Bailey, *l. c.*, p. 282.

ing districts." He measured several of them. The tallest man, and one towering considerably above his fellows, was only 5 ft. 3 in. in height; he was a more civilised Veḍdá from Bintẹnna. The shortest whom he saw measured was 4 ft. 1 in. He considers the average height of the men from 4 ft. 6 in. to 5 ft. 1 in., and the women from 4 ft. 4 in. to 4 ft. 8 in. In a list of measurements taken at his suggestion, two men are reported as 5 ft. 3 in. and one as 5 ft. 3⅖ in. If these measurements are correct, they exceed, in his opinion, the average measure. Among fourteen Veḍdás of Bintẹnna, the tallest was 5 ft. 3⅖ in., the shortest 4 ft. 6¼ in.; the medium was about 5 ft. ½ in. Of twelve women, the tallest was 5 ft. 2½ in., the shortest 4 ft. 4½ in., the medium about 4 ft. 9 in.

Mr. Hartshorne* gives only two measurements of persons, whom he believes to be fairly average specimens of the race. One of them, Latty, eighteen years of age, was 5 ft. 4¼ in. in height; the other, Bandiey, about twenty-five years old, measured 4 ft. 11¾ in.

If we reckon this in metres, we have the following :—

The tallest man	...	1,638 mm.
The shortest man	...	1,245 mm.

The medium, according to measurements taken in Bintẹnna:—

For the men	...	1,537 mm.
For the women	...	1,448 mm.

The conclusion to which we arrive is that the Veḍdás are a very small, not to say dwarfish, race.

In reference to details of the size, the majority of observers in reality present no facts which indicate disproportionate or imperfect development of the separate members of the body. Only Mr. Hartshorne, who characterised the general appearance of the Veḍdás as "distinctly non-Aryan," asserts that they have short thumbs and sharp-pointed elbows. It would be very satisfactory if these accounts could be corroborated by fresh observations.

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* Hartshorne, *l. c.*, p. 408, note.

The complexion of the Veddás is dark,—according to most reports, darker than that of their neighbours, the Siṉhalese, of whom Davy says, that their colour varies from light brown even to black. Bailey speaks of the colour as dark, or rather dusky, by which, at any rate, a very deep shade is meant.

The hair of the head and beard Davy describes as long and matted; it is never cut or combed. Sir E. Tennent* says: "Their long, black hair and beards fell down to their middle in uncombed lumps." Sirr† reports that "their hair, beards, and whiskers are never shorn or cleansed, and these redundant tresses hang over their shoulders and bosom in matted masses." Bailey calls the beard "short and scant; the hair of the head, which is not curly, falls in rusty, tangled masses about the face," making the head appear disproportionately large. Later, he speaks of "their wild shaggy hair." When one sees the people, he says, with their rugged, uncombed locks half-covering their faces, they fully represent a preconceived idea of barbarous savages. Hartshorne‡ calls the hair of the head "coarse" and "flowing," and considers it necessary to add that their bodies are by no means hirsute, and that there is no tendency of the hair to converge towards the elbows, or to diverge from the chin, or *vice versâ.*

Through the kindness of Mr. Bastian, two photographs have been sent me of a company of Veddás, which he obtained in Colombo. They represent three men and three women in full figure, but unfortunately of too small a size to give a clear idea of them. This was the party, it seems, presented to the Prince of Wales on the occasion of his visit to the Island. Mr. Hartshorne, who, to be sure, only speaks of two men and three women, is of the opinion that they came from the district of Batticaloa, where the few Veddás still remaining, partly through the influence of the missionaries, partly through

* Tennent, *l. c.*, vol. II., p. 449.

† H. Ch. Sirr, Ceylon and the Siṉhalese. London, 1850, vol. II., p. 210.

‡ Hartshorn, *l. c.*, pp. 408, 409.

marriage with the Tamils, have lost many distinctive features of their primitive state. "Two of the women," he says, "were very gentle in appearance, and one is reported to have been decidedly pretty; the two men were described as small and rather ape-like." To these descriptions the photographs aforementioned correspond pretty well.

Though these may not be examples of the purely savage Veddās, I have nevertheless, in lack of any other representations, asked Mr. Mützel to make a drawing of two men and one woman, from which a woodcut* has been prepared. It shows plainly the growth of the hair; the noses comparatively short, broad at the end, and flattened; the eyes apparently deep-set, and the lips of the younger persons full and bulging; so that it gives a far more vivid idea of the people than any description could furnish. One only of the men has anything like a beard. We see the little apron worn by the men, the great bows they carry, the arrows with the leaf-shaped points, and finally the iron axe stuck in the girdle.

As regards the hair, it is comparatively long with all the six persons, but evidently put into some shape by the help of a comb. The women wear their smooth, slightly waving hair parted in the middle, and so does one of the men, who certainly exhibits his *chevulure* in a somewhat disordered condition. Two of the men have curly hair, which forms a bush about the head, sticking out widely and falling down upon the neck, exactly corresponding to all the known descriptions of them. This makes the head appear very large, especially in proportion to the lean body and limbs. But it must here be particularly remarked that this curly hair is never in small, tight rolls as among the Negritos, and the bush of hair does not in the slightest degree approach the peruke, such as is generally worn by the Viti people, or the Abyssinian tribes; on the contrary, the curly hair is very long, and falls down pretty low upon the

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* Not reproduced here.—*Hon. Sec.*

neck, and it is therefore out of the question to talk of woolly hair. It is a comparatively smooth, simply wavy hair, occasionally curly, but remarkable for its length, and just as Palladius describes it, in a most pregnant manner, ἀκαρτα καὶ ἀπλότριχα. We must here add that he expressly contrasts these smooth-haired people with the Indians (Negroes), whom he calls φριξότριχες. Of the eyes, Davy only mentions that they are lively, wild, and restless. Valentijn calls them burning. Bailey speaks of them as "good, and often full." Only Mr. Bennett asserts that they are small, which probably means deep-set. With regard to their colour, I find nothing said. But the statements are sufficient at any rate to prove to us *that the Vẹddás are a dark, but not actually black, race, and not woolly-haired like the Negro.*

Hartshorne says of the noses, like Sir E. Tennent, that they are flat; and of the lips, that they are sometimes thick. If we add to this their short thumbs and sharp-pointed elbows, there are indications enough by which to distinguish them in a noticeable degree from the Oriental races living in their neighbourhood. Bailey calls the nose "well-shaped, though inclining to be flat; the nostrils wide; the mouth sometimes large; and the lips firm, but rather thick;"—the features of the face, on the whole, "tolerably regular." Sir E. Tennent describes the mouth as "projecting," and the teeth as "prominent."

Before comparing this picture with that of any other of the neighbouring people, I will add some craniological observations. By an especially happy accident I was enabled myself to examine three Vẹddá skulls. I had applied to the German Consul in Colombo, Mr. Ph. Freüdenberg, when he was here, to obtain, if possible, skulls from Ceylon, and especially of the Vẹddás. He wrote to me on February 27, last year, that he was sorry he himself could not do this; but that the Governor and Committee of the Museum in Colombo had declared themselves ready to send here as a loan for six months any skulls I might wish to have from their Museum.

These arrived in the summer, accompanied with a note from Mr. A. Haly, the Director of the Museum in Colombo. To all these gentlemen I would express my most sincere thanks for their very great kindness in thus furthering my wishes. I will proceed to give a brief description of the skulls.

Skull No. 1.

Mr. Haly appends to it the following note :—

"Presented by Mr. W. W. Hume, Government Agent, Southern Province.

"This skull is said to be that of a Vẹddá woman, and was found at Dewilanê near Batticaloa, but there seems to be no evidence to show that it is a Vẹddá skull."

Plainly a woman's skull, very white, smooth, and of little capacity (1,250 cub. cm.), with teeth much worn away. Whether an under-jaw belongs to it is questionable, for although the condyloid processes of the one fit tolerably, it yet appears somewhat too short; hence it is omitted in the drawing.* The capsule of the skull is long, narrow, and flat, of a pronounced dolichocephalous index (70·9). The brow is quite straight, but not high, without marked orbital prominences, but with strong *tubera ;* the *glabella* not much sunk, and at the nasal process remnant of the frontal suture one centimetre long. The curve of the parietal bone appears long at a side view; so also the narrow backhead. The *norma occipitalis* shows a slightly ogivalous form, but has, on the whole, a rounded outline narrowing toward the bottom. On the high and pointed *squama occipitalis* we find no distinct *protuberontia externa*, but strong cerebellar arches.

The sutures are well preserved and pretty deeply indented. On either side are temporary interpolations of bone ; to the right an oblong bone extending the whole length, with a slight degree of stenokrotaphy and low *angulus parietalis ;* to the left an imperfect bone, but only in the posterior half of the sphenoparietal suture, beside which the point of the

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* The drawings of the skulls are not reproduced.—*Hon. Sec.*

ala sphenoidealis comes up high, whilst the *angulus parietalis* is low; likewise in the under part of the lambdoidal suture on either side and on the posterior lateral fontanel interpolation.

A view of the skull from below shows plainly the length and narrowness of the occipital region. The very large *foranen magnum* is injured at the posterior edge, but can be measured approximately. The articular processes of the occipital bone are situated quite anteriorly, and their fascets turned rather to the outside. Small mastoid processes.

In the front view the forehead appears comparatively broad, the face short and of moderate breadth. Index 83·1; therefore chamæprosopic. The very large orbits are likewise broad and extended toward the outside and the bottom, but on the whole rather round in form. Their index amounts to 84·6, and therefore mesokonch. The cheek bones project, and the canine *fossæ* are correspondingly very deep; on the other hand, the zygomatic arches are not very prominent. The nose is rather high on the face, and somewhat to one side, narrow at its root, the ridge bent in, the aperture large. Index 50, therefore mesorrhine. The upper jaw is, on the whole, low, especially at the alveolar process, which is slightly prognathous; the facial angle (brow-nasal spine and auricular orifice) measures 82. The palate long and broad toward the back, the alveolar line somewhat in the form of a horseshoe, and the teeth and the alveolar cavities, especially in the front, large. Index leptostaphyline, 75. The (questionable, therefore omitted in the drawing) under jaw, small and low, the rami slanting and feeble, and particularly narrow. The distance of the maxillary angle amounts to only 85 mm., or 10 mm. less than the lower frontal breadth.

(2).—*Skull No. 4.*

Mr. Haly designates it as evidently abnormal, and says of it and the following (No. 5): "They were procured by the Rev. S. Somanader, the Veḍdá missionary at Batticaloa. There is a lower jawbone, but I do not know to which skull

it belongs. Mr. Somanader guarantees these as being the skulls of absolutely pure-blooded Vęddás, a race, he says, now almost extinct."

The skull, in all probability female, is without a face. Perhaps there belonged to it a senile under-jaw with totally obliterated alveolar cavities, perpendicular and delicate rami and condyles, which, by *arthritis chronica senilis*, are changed ; the skull, however, does not give the impression of having belonged to such a very old person. This skull is unusually small ; its measure inside is only 1,025 cub. cm.; it is therefore almost nannocephalous. It is, beside being very crooked, especially depressed on the left side posteriorly, short, though rather broad and high. The index amounts to 80·6 ; it is therefore brachycephalous. The reason for this abnormity is probably an artificial, or accidental, deformation ; for although it has a *synosteosis* of the under coronal and the spheno-frontal suture, the main aberrations are in the occipital region. The other sutures are much indented. The *squama occipitalis* is very high, and the lambdoidal angle acute ; no *protuberantia externa*. *Tubera* on the brow and parietal bones strongly developed ; the brow much arched. *Orbitæ*, so far as their form is recognisable, very large.

Skull No. 5.

This is a male skull, unfortunately also without a face, but in all other respects quite uninjured. Its capacity is considerably greater (1,360 cub. cm.) than that of the two female skulls, but in itself not large. The surface is covered with distinct traces of muscle, especially the back head, where the *facies (muscularis squamæ occipitalis)* show very deep impressions : the *protuberantia externa* is unusually strong and hooked in form, and the *linea semi-circularis superior* makes a strong V-shaped projection. Also the nasal and orbital prominences are strong, although not specially large. The capsule of the skull is distinctly dolichocephalous, with an index of 73, showing in a side view a long finely-

arched curve, with full high brow and round, strongly projecting back head. The sutures are well preserved; only the under portions of the coronarie and the *spheno-frontalis* are synosteotic. In spite of this the temporal regions are on the whole well formed. From a posterior view this skull also has an ogivalous form, yet with greater breadth of basis. The *squama occipitalis* is high, and the lambdoidal angle very acute. The cerebellar arches large. At the basis the occipital region appears unusually long. The *processus condyloides* are very prominent, and the articular facets turned decidely outward. The mastoid process strong. In a front view the forehead appears broad; the nasal root somewhat deep, but narrow; the bridge of the nose erect; the *orbita* large and slightly rounded; the zygomatic arch not prominent.

Although Mr. Haly says there is no proof that skull No. 1 is a Veḍdá skull, yet I see no reason why it should not be considered as such. Batticaloa is, as we learn from the preceding accounts, known to be the old Veḍdá region; and the statement of Mr. Hume that it is the skull of a Veḍdá woman must have been founded on distinct circumstantial evidence. Certainly it is the skull of a woman; and since also it coincides with other Veḍdá skulls, I do not scruple to accept it as such. The circumstance that there is nothing about it corresponding to the usual idea of the skull of a savage cannot be of any weight, since the rest of the skulls also impress us as being comparatively delicate, not to say civilised. This is a peculiarity which belongs to different unquestionably savage inhabitants of the Eastern Archipelago, and which is especially conspicuous among the Andamanese, the Negritos of the Phillipines, and many other savage tribes in the mountains of Hindústán. The origin of the two other skulls is so clearly testified to by the missionary of that region, Mr. Somanader, that there is no room for doubt.

For comparison we have a not inconsiderable number of apparently well-ascertained skulls now to be found in

England. Of these, eleven were in possession of Mr. Barnard Davis, who has given notices of them in his "Thesaurus Craniorum": London, 1867, p. 130. Among them are four, likewise from Batticaloa, two from Badulla, and two from Uva. Some are damaged, and must therefore be set aside in our examination. Nine other Vẹddá skulls are found in the great anthropological collection in the Hunter Museum; their measures have lately been published by Mr. W. H. Flower in his "Catalogue of the Specimens Illustrating the Osteology and Dentition of Vertebrated Animals contained in the Museum of the Royal College of Surgeons of England": London, 1879, Part I., p. 111. Among them are also those which Mr. George Busle (Proc. Linn. Soc., 1862, vol. 6, p. 166) has earlier described. Of two of these it is stated that they are from Nilgala. The two last and the one from Bintẹnna (Badulla) are furnished by Mr. Bailey. A picture of one of the men's skulls from Bintẹnna (No. 675) is given in the work of the Messieurs de Quatrefages and Hamy, "Crania Ethnica," Paris, 1876-77. Of two others (Nos. 681 and 682), it is especially said that they may be considered authentic specimens.

In all, we have then, twenty-three skulls for comparison. Among them there is, beside the above-mentioned deformed skull (No. 4) from the Museum at Colombo, another from the Hunter Museum (No. 676), one from the Bailey collection, brought from Bintẹnna, of which it is expressly asserted that "it has been unsymmetrically distorted by occipital pressure." These two must, therefore, be excluded from certain examinations. The rest of the anomalies, however important they may be, can in the main be passed over. I will only briefly call attention to the fact that the skull I have described, No. 1 from the Colombo Museum, shows some temporary aberrations, especially interpolations of bone, and also that the skull represented by the Messieurs de Quatrefages and Hamy, No. 675, out of the London Museum, shows distinct stenokraphy.

The total result obtained is, first, that the Vẹddá skull is uncommonly small, and that occasionally genuine nannocephaly appears in the race.

Of the deformed skull out of the Colombo Museum (No. 4) I have already pointed out that it possessed only a capacity of 1,025 cub. cm. Mr. Flower has discovered even a smaller one, that of an adult woman (No. 679), which measures only 960 cub. cm., and of which he says "that is the very smallest in the whole collection." Here we must particularly remark that it is not a question of microcephaly, in the pathological sense, but of crania justo minora. In order to avoid confusion, I have therefore chosen the name, which I have suggested in an earlier essay, of nannocephalous.

I give in the following a list of some of the measurements, as the fact just signalised is of special importance for the cognisance of races. Regarding the skulls of Mr. Bernard Davis, the first column shows the weight of the sand used in measurement, as given by him; the second and third columns give the reduction of the weights into measures, according to the table made by Mr. Weleker:—

I.—Statements of Mr. Davis.*

No.	Weight. oz.	Men. cub. cm.	Women. cub. cm.
1	64	1,275	—
6	70	1,394	—
7	56	—	1,115
8	65	—	1,295
9	64½	—	1,275
10	81	1,614	—
11	59	—	1,175
12	72·5	—	1,444

Average of	3 men's skulls	1,428 cub. cm.
Do.	5 women's skulls ...	1,261 „
Do.	8 Vẹddás' skulls ...	1,323 „

* Virchow, "Gesammelte Abhandlungen zur wissenschafhlichen medicin." Frankfurt, A.M., 1856, s. 901.

II.—Statements of Mr. Flower.*

No.		Men. cub. cm.		Women. cub. cm.		Uncertain. cub. cm.
675	...	1,140	...	—	...	—
676	...	—	...	1,225	...	—
677	...	—	...	—	...	1,235
678	...	—	...	1,250	...	—
679	...	—	...	960	...	—
680	...	1,225	...	—	...	—
681	...	1,260	...	—	...	—
682	...	1,420	...	—	...	—
683	...	—	...	—	...	1300

Average of	4 men's skulls ...	...	1,261 cub. cm.
Do.	3 women's skulls	...	1,145 „
Do.	2 uncertain skulls	...	1,269 „
Do.	9 Vẹddás' skulls	...	1,224 „

III.—My own Statements.

No.		Men. cub. cm.		Women. cub. cm.
1	...	—	...	1,250
4	...	—	...	1,025
5	...	1,360	...	—

Average of	3 Vẹddás' skulls...	...	1,211 cub. cm.
Do.	20 Vẹddás' skulls...	...	1,261 „
Do.	8 men's skulls ...	...	1,336 „
Do.	10 women's skulls	...	1,201 „

Only two men's skulls, viz., No. 10 among Mr. Davis's and No. 682 among Mr. Flower's, exceed 1,400. The first measures 1,614 cub. cm., and is called by Mr. Davis himself "abnormally large"; the other measures 1,420 cub. cm. All the rest of the measurements given are much less,—three between 1,100 and 1,200 cub. cm. and eight between 1,200 and 1,300 cub. cm. The average of 1,261 computed above may, therefore, be esteemed a pretty fair measure.

The amount of the variation is particularly worthy of attention. If we take the two extremes, the woman's skull

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* Archiv. für Anthropologie. Bd., *l. s.*, 272.

of 960 and the man's of 1,614 cub. cm., we have a difference of 654. The different ways of measuring may possibly have increased the difference a little, but not enough to be of any importance.

The length measures stand in a close, but nowise simple, relation to the capacity. In regard to the horizontal extent from the reports of Mr. Davis, I calculate as the average of three male skulls 19·9 English inches = 506 mm., the average of eight female skulls 19 in. = 483 mm., and the average of thirteen skulls altogether 19·2 in. = 488 mm. From the figures given by Mr. Flower accrues an average from five male skulls of 485, of two female skulls of 454, and of seven skulls altogether 476 mm. From my measurements accrues for three skulls an average of 486 mm., a figure pretty near to the others. From all the twenty-three skulls I calculate an average of 484 mm.; from Mr. Davis's skulls and mine, sixteen altogether, an average of 487 mm. The lowest measure (448) was found by Mr. Flower with the nannocephalous girl, the highest (512) with a man; so here too we have a difference in the extremes of 64 mm. The skulls I have described prove here also absolutely typical.

The measurement of the vertical line (right across the head) admits of no exact comparison, since my measure extends from one auditory passage to the other, that of Mr. Davis from the base of one mastoid process to the base of the other. Mr. Flower has not given any vertical lengths whatever. According to my measurements the vertical extent is comparatively small, on the average only 289 mm., which is 197 mm. less than the horizontal extent, of which it is only 5·94 per cent. This figure shows most clearly the narrowness of the skull.

It is very difficult to measure the upper vertical extent (sagittal from the root of the nose across the parietal bone to the *foramen occipitale*) which differs, according to our two statements, in the whole as well as in the single parts. It amounts on the average :—

	Davis. mm.		Virchow. mm.
Frontal vertical extent	124·5	...	123·0
Parietal ...	127·0	...	121·0
Occipital ...	114·3	...	111·0
Whole sagittal arch ...	365·8	...	355·0

Average ... 360·4 mm.

or reckoned by the percentage of the entire sagittal arch :—

	mm.		mm.
Frontal vertical extent	34·0	...	34·6
Parietal ...	34·7	...	34·0
Occipital ...	31·2	...	31·2
	100·0		100·0

Here the figures agree at least as far as regards the share of the *squama occipitale* in the formation of the roof of the skull : they show that to the *squama* belongs a considerable share, almost a third, and this may well be looked upon as a characteristic.

The relation of the extent in length to the horizontal extent varies only a little in the two measurements. It amounts by mine to 73·0, by Mr. Davis's to 74·9, on the average 74·5 per cent. of the horizontal extent, which, compared with relation to the vertical extent, is a very considerable figure.

Much more homogeneous are the results of the measurements in regard to the form of the head.

The average index of ratio between length and breadth is decidedly dolichocephalous. It amounts with :—

			mm.
Mr. Davis, from 10 skulls, to	...	...	71·3
Mr. Flower, from 8 skulls, to	...	...	71·9
Myself, from 2 skulls, to	...	...	71·9
Total from 20 skulls	...	...	71·6

We have here omitted to bring into the account the two before-mentioned deformed skulls, which have a brachycephalous index ; the one in the London Museum has an index of 82·9, the other from the Colombo Museum of 80·6.

To these must be added the skull of a girl of Batticaloa, about eighteen years of age, and now in the possession of Mr. Davis (No. 803), which he himself calls an "aberrant example," with an index of 78. To what cause due one cannot conceive from the description, since the only thing mentioned about it is that it has a *processus papillaris* before the *foramen magnum*.

Possibly deforming influences were at work among the female Veddás to a greater extent, though in a less noticeable manner. At least we calculate from the figures of Mr. Davis, even omitting the probably deformed skull, a higher index for the female than the male skulls. Mr. Flower and myself, however, arrive at the opposite result, excluding the deformed skulls, viz.:—

		Davis.			Flower.			Virchow.
		mm.			mm.			mm.
For Men ...	(3)	69·6	...	(5)	70·9	...	(1)	73·0
For Women ...	(6)	71·0	...	(1)	69·9	...	(1)	70·9

In taking the average of the two sexes together, however, the difference disappears, as then Mr. Flower's and my own lower figures count for something, viz.:—

			mm.
Men ...	9 skulls	...	70 7
Women ...	8 skulls	...	70·8

At any rate, we have among the number (twenty in all) which come into the calculation, only four belonging to mesocephaly (index of 75 : 1—80). Among the remaining sixteen, however, are seven whose index amounts to something under 70, which are therefore hyper-dolichocephalous. The minimum amounts to 66 (Davis). Quite correct also was Mr. Davis in saying (*l. c.*, p. 132) that the Veddá skulls are narrower than those of African Negroes, and sometimes as narrow as those of the New Caledonians. The relation of the single parts of the skull to the whole length = 100 is somewhat different. With the male skull No. 3 the horizontal length of the occipital region is greater, and the frontal basilar length less. If we indicate the relation of the

occipital length to the whole length by a, and that of the basilar length (outer edge of the *foramen magnum* to the root of the nose) by b, we obtain for the skull :—

		No. 1.		No. 2.		No. 3.
		mm.		mm.		mm.
a	... ...	28·2	...	27·8	...	32·4
b	... ...	51·9	...	55·1	...	48·6

Corresponding to the smallness of the skull, the greatest length is throughout little : dolichocephaly is less indicated by great length than by want of breadth. Among all the skulls there is only one—a male skull (Davis, No. 805)—which has a length of 190 mm. (76 English inches). With all the rest it is less, with the majority not more than 180. The greatest breadth, likewise, comes up in only one skull to 140 mm. ; the next highest figure is 135—the measure of the male skull from the Colombo Museum. But the majority do not even reach 130. All the more extraordinary is the relatively considerable height. Only twice do we find height less than the breadth. The skull (No. 683, Mr. Flower's) which shows some other aberrations as well, has a breadth of 140 mm. and a height of only 135 mm.; and a male skull (Davis, No. 804) that shows various synosteoses, and is clinacephalous, has a height (5 in.) a little less than the breadth ; in all the other cases the height exceeds the breadth, and not set down very considerably—in one case (Flower's, No. 680) by 14 mm. The greatest height (136 and 137 mm.) is that of two male skulls —one of Mr. Flower's and one of mine.

The index of ratio between the length and height is, therefore, greater than between the length and breadth. After excluding the two deformed skulls, it amounts to an average of :—

		Men.			Women.	
Mr. Davis	...	(3)	. 73·6	...	(7)	. 76·2
Mr. Flower	...	(5)	. 75·0	...	(1)	. 71·1
Mine	...	(1)	. 74·1	...	(1)	. 72·9
In the whole		(9)	. 74·9		(9)	. 75·3

The average from the collection amounts to 74·9. We

cannot therefore exactly speak of lypsicephaly, though the form comes very near to this type. If we reckon orthocephaly at 75, or even at 74·9, the Veḍdá skull on an average falls below this category.

The height of the ear, which has only been taken by me (vertical distance of the upper edge of the outer auricular passage from the parietal bone), is likewise considerable, particularly in the male skulls, amounting to 120 mm. In this case the index of the height of the ear amounts to 64·9, whilst in the female skull No. 1 it reaches to only 60·4, and even with the deformed one (No. 4) only to 63·0.

As regards the formation of the face, I find, except the already-given descriptions, little osteological support. Of single regions I mention the eye-cavities and the nose.

The orbital index was, in the one case which afforded me an opportunity of taking the measurements, 84·6, exactly the same figure which gives the average in the statements of Mr. Flower. The single cases certainly show very considerable differences, for, according to Mr. Flower, we have among eight skulls: two indices below 80, two between 80 and 85, and four over 85 up to 91·7. Separating the sexes, we have from four male skulls an average of 85·1, from two female 84·3, a difference scarcely worth mentioning. On the whole we may therefore assume that the orbital formation is mesokonch.

The nasal index, which I stated at 50, is, according to Mr. Flower, who compared seven cases, 52·2; it is therefore mesorrhine, bordering on platyrrhine.

There certainly seems to be a not inconsiderable difference in sex, since the two female skulls cited by Mr. Flower were platyrrhine (56·1 and 57·8); and, on the other hand, among the male skulls one, if not two, were leptorrhine (46·5 and [?] 46·7), and only two platyrrhine (54·0 and 54·3). The depressed form of the bone of the nose is plainly seen in Table 1, Fig 3, and in the profile drawing by Messrs. De Quatrefages and Hamy. The previously given descriptions

of Sir E. Tennent, Bailey, and Hartshorne, which emphasise the flatness of the nose, are in unison with this; and the pictures I have given, taken from photographs, also show plainly the depressed form of the root of the nose and the breadth of the rings.

The face altogether seems to be low, flattened throughout. The front view of the skull given by the Messrs. de Quatrefages and Hamy in their pictures exhibits this in a splendid manner. I obtained an index (relation of the entire facial height to the breadth of the zygomatic bone) of 83·1.

From the measurements of Mr. Davis I calculate as an average of five skulls almost the same figure, viz., 83·8. According to this the type is therefore, on the whole, chamæprosopous; and, as far as I can now discover, with the women more than with the men. The skulls of Mr. Bernard Davis show :—

No.		Men. mm.		Women. mm.
313	...	88·2	...	—
801	...	87·5	...	—
802	...	—	...	82·9
803	...	—	...	80·8
804	...	—	...	80·0
Average	...	87·8	...	81·2

Notwithstanding the depression of the faces, they are not actually broad. It is because of the slight prominence of the zygomatic arches and bones which Mr. Bernard Davis has already mentioned in contrast to the African races. Only the London skull, of which Messrs. de Quatrefages and Hamy have given us a picture, appears comparatively broad, and chiefly, it would seem, owing to the strong development of the *processus zygomaticus* of the maxillary bone, and the consequently increased size of the lower zygomatic protuberance.

Mr. Flower calculates, besides the alreolar index, the means by this, the present relation of the "basilar alvesli" length

(distance of the anterior edge of the alveolar process from the *foramen occipitale magnum*) to the "basinasel length" (distance of the root of the nose from the *foramen magnum*): the latter, supposed, = 100. The average of six skulls gives a figure of 96·3. I obtain only 93·4 for the female skull from the Colombo Museum. Separating the sexes the computation of Mr. Flower is :—

No.	For Men. mm.	For Women. mm.
675	93·5	—
676	—	93·0
678	101·0	—
679	—	96·5
680	96·9	—
681	97·1	—
Average	97·1	94·7

According to this it might appear as if prognathy was greater among the men than among the women, but we must reserve a final opinion on this point, since the measurements of individual skulls show such considerable differences, especially with the males. At any rate, prognathy is very slight. Mr. Bernard Davis goes so far even as to call the Veddá skulls tolerably orthognathous.

With regard to the proportions of the rest of the body, I have a few more statements from Mr. Hartshorne about two Veddás, which I subjoin, after having changed them into metre measure :—

	Latty, about 18 years old. mm.	Bandiey, about 25 years old. mm.
Height of the body	1,631·91	1,517·59
Circumference of the head around middle of the brow	514·33	514·33
From top of forehead to end of chin	168·25	177·80
Across face	133·34	171·42
Shoulder to elbow	279·39	323·81
Elbow to wrist	254·00	219·05

		Latty, about 18 years old. mm.		Bandiey, about 35 years old. mm.
Wrist to point of middle finger		196·82	...	174·59
Size of upper arm around the biceps	right ...	260 34	...	241·28
	left ...	263·51	...	241·28
Size of forearm	right ...	222·22	...	222·22
	left ...	222·22	...	222·22
Chest, breadth	...	787·39	...	749·27
Length of upper thigh	...	425·41	...	419·07
From knee to ankle	...	412·73	...	393·67
Size of the calf	...	298·41	...	292·07
Sole of the foot	...	241·28	...	222·22

It is very probable that errors have crept into some of these measurements, especially with regard to the upper arm (shoulder to elbow), which, with the smaller man, is stated to be 44 mm. longer, whilst the whole arm is almost 13 mm. shorter. The breadth of the face also given for Bandiey, the smaller man, is not only 38 mm. more than for the much larger Latty, but of an incredible size altogether. We must, therefore, be very cautious in using these figures. Tolerably constant is the relation of the sole of the foot to the height of the body : with Latty it is 6·7, with Bandiey 6·8, contained in the height of the body. This is quite a normal relation. Mr. Bennett says the hands of the Vẹddás are small, but their feet long and flat. This may be so : one would hardly think it, however, from the measures given. Of the remainder of the measurements I have not much to say, especially as with some of them, *e.g.*, the length of the upper arm, it is not said where the measure begins and where it ends. This much at least we may conclude from the statements, that the single parts may be assumed to be well proportioned. Of special interest is only the size of the arm, whilst there is a marked difference in general between the right and the left arm. We find here on both sides the same figures—indeed, with Latty the size of the left upper arm is a little more than 3 mm. larger than that of the right. This is to be accounted for by the greater exercise of the left arm,

which is specially strained in drawing the very heavy bow, as has been described by various travellers. Mr. Bernard Davis has in his collection the upper thigh and upper arm of a Veḍdá : the former is 17·2 in. = 436·8 mm. in length, the latter 12 in. = 304·8 mm. This was evidently a very strong individual : the length of the upper thigh exceeds even that of the two men measured by Mr. Hartshorne (425 and 419 mm.). On the other hand, the length of the upper arm, according to Davis, does not coincide with the figures given by Hartshorne, and this is additional proof of the inexactness of his measurements.

The comparison of the Veḍdás with their neighbours on the Island is not a little increased in difficulty from the lack of sufficient information with regard to the relative physical condition of the latter. Even the best describers limit themselves in the main to a few words. Regarding the more civilised tribes, as already well known, they at most therefore institute only comparisons with the continental tribes of Hindústán or with the European. Osteological material is also comparatively scanty in the European collections, and even what there is appears to me as rather unsafe. I have, through the kindness of Consul Freüdenberg, received three skulls of Siṅhalese and three of the Tamils ; but examination proves one designated as the skull of a Siṅhalese child to coincide so exactly with the Tamils, that it seems very doubtful indeed if this is correctly stated. The inhabitants of the low lands upon the Island have so frequently trespassed on each other's territory, and become so intermingled in life, that their skulls may have been confounded after death. Hence I offer the following remarks with all reserve, and principally with the aim of provoking, if possible, more exact information and the sending of better material. In particular I must indicate, as the greatest desideratum, the need of satisfactory photo-

graphs,—especially half-lengths,—not too small (profile and front face), in the right horizontal position.

In our comparisons the genuine Sinhalese and the Tamils come chiefly under consideration. Only collaterally can the descendants of the immigrant Arabs (Moors, Moormen), Malays, and still less Chinese, Burmese, Aryan Indians, African Negroes, and Europeans, be brought in. The two first-named tribes are so predominant, through the extent of territory they occupy, as well as from their numbers, that, apart from their almost exclusive historical claims, they must be specially considered.

The Sinhalese.

They occupy in the main the south and south-west of the country. According to Sir E. Tennent* the inhabitants of the south coast from Galle to Hambantoṭa are the purest Sinhalese. This part formed an important division of the old province of Ruhuna, which was very early colonised by the descendants of Wijayo; they neither intermingled with the Malabars nor had any intercourse with them whatsoever. Unfortunately Sir E. Tennent gives no actual description of the people. He only speaks incidentally of their build, and their hair; what chiefly caught his attention was their inclination to an effeminate mode of arraying themselves. This is especially conspicuous in the way of wearing the hair, of which he gives a picture; but adds, this applies only to the people of the south-west coast, and not to those in the interior or in the north or east. They let the hair grow long, comb it *à l'impératrice*, high from front to back, and bringing it up from the nape of the neck form a roll (*koṇḍé*) on the protruding part of the back head, fastening the whole with combs. Even Ptolemy has mentioned the long hair in Taprobane, and Agathemerus asserts that the men of Ceylon let their hair grow as long as it will, and roll it into a coil on the top of the head in the fashion of women.

* Tennent, *l. c.*, vol. II., pp. 106–112.

Of the children Sir E. Tennent says they are beautiful, with wavy shining hair. He says a group of children in their nakedness look like living bronzes. The men also have delicate features and slender limbs, are frequently beardless,* and wear around the hips a piece of cloth (*comboy*) like an under petticoat, so that altogether the impression they make is womanish. Finally, he adds a notice of them from a Chinese book of travel by Hiouen Thsang, in which the Mongolian expresses his amazement at their prominent noses, by saying the Siṇhalese have a bird's beak on a human body.

This is about all that I find in Sir E. Tennent concerning the Siṇhalese. The few paragraphs devoted to the inhabitants of Ceylon by Mr. Von Schlagintweit† coincide with this. Somewhat more definite, though very superficial, are the reports of earlier authors. Valentyn‡ says : "De Cingaleezen zijn niet heel swart, maar bruyngeel, lang en open van ooren, niet klock von gestalt, door de bank wat mager, zeer zwak van leden, geschwind van licham en vrijser ruf tig van geest." Wolf§ declares outright "the Siṇhalese have a black skin." Percival‖ ascribes to the Ceylonese a stature of middle height, about 5 ft. 7 in., and says the colour of the women approaches to yellow. Selkirk¶ calls the eyes of the Siṇhalese bright black, and says the hair is long, black, and fastened into a knot. The insides of the hands and feet are white, the rest of the body black. The people in the interior seldom shave the beard, but those on the coast do. Sirr** says the men are under middle height, something like 5 ft. 6 in. on an average, and well propor-

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* These statements are said to be found in the history of Tambulus. Diodor, Lib. 2, cap. 36.

† Herman von Schlagintweit, Sakunlunski. Reisen in Indien and Hoch Asien. Jena, 1869. Bd., *l. s.*, 213.

‡ Valentyn, *l. c.*, Bl. 43.

§ Wolf, *l. s.*, 155.

‖ Percival, *l. s.*, 222.

¶ Selkirk, Recollections. London, 1884, pp. 58-59 of Ceylon.

** Sirr, *l. c.*, vol. II., p. 38.

tioned. Their colour varies from clear yellow-brown to black; hair and eyes the colour of ebony. The Kandyans are darker, more powerful, and of better growth. Philalethes,* who specially refers to Valentyn, says the colour of the Siṇhalese is not quite black, but of a deep chestnut, suffused with a yellow tint. Their ears are long and open, their bodies not powerful, but slender and agile.

Much more exact is the description which Mr. Davy† gives. He divides the Siṇhalese race into three great tribes: the genuine Siṇhalese, the Kandyans, and the Vẹddás. In describing chiefly the inhabitants of the interior of the Island, "the highlanders," he says that they are in build, speech, manners, customs, religion, and government complete Indians. Like them they are distinguished from Europeans less in the features than in some trifling characteristics of colour, size, and form. The complexion ranges from light brown to black. Also the colour of the hair and the eyes varies, although not so often as that of the skin; black hair and eyes are most common, and brown hair and eyes less uncommon than gray eyes and red hair, and the light-blue or red eyes and flaxen hair of the Albinos. In size, the inland people exceed the low-land Siṇhalese and the most of the natives born on the coast of Coromandel and Malabar, but they do not attain the height of the European. Their average is somewhere about 5 ft. 4 to 5 in. They are clean-made, with neat muscle and small bone. For Indians they are stout, and have, as a rule, well-developed chests and broad shoulders, especially in the mountain districts, where they, like other highlanders, have rather short but strong and very muscular thighs and legs. Hands and feet are in general very small,—indeed disproportionately so compared with ours. The form of the head is good, but perhaps rather longer than among Europeans. Their features are commonly neat and often handsome, their countenances intelligent and

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* Philalethes, *l. c.*, p. 231. † Davy, *l. c.*, p. 109.

animated. Nature has given them a wealth of hair, which, in general, they allow to grow to considerable length on their faces, as well as heads, since in their opinion a beard, so far from disfiguring, adorns the face. The women as a rule are well formed and good looking, often handsome. According to their opinion a beautiful woman should have the following attributes:—Hair luxuriant, like the tail of a peacock, long, reaching to the knees, and terminating in graceful curls; eyebrows like the rainbow, and eyes sapphire blue, or like the petals of the blue *mánil* blossom; nose like a hawk's beak, and lips bright and red as coral or the young leaves of the *ná* tree; teeth small, regular, and closely set as the buds of the jasmine; neck full and round; chest capacious, and breasts firm and conical, like the yellow cocoanut; waist almost small enough to be spanned by the hand; hips wide; limbs tapering; the soles of her feet without hollows, and the surface of her body soft, delicate, smooth, and rounded, without protruding bones and sinews.

Davy has the great merit of having added to his work a series of pictures, which illustrate more clearly many of these particulars. On Plate 6 is found a coloured group of Kandyans, after a drawing by Lieut. W. Lyttleton, which shows very clearly the dark-brown complexion of the common people by the side of the lighter yellowish-brown tint of the Disávé: the faces are comparatively long and narrow, the noses arched and very prominent, the upper lips short, and the muscles about the mouth delicate. On Plate 4 likenesses are given, which were drawn from ivory figures carved by native artists; here the faces are shorter and somewhat broader; the noses very prominent and arched, having an almost Jewish expression; the lips (especially of the women) full and bulging, but without any approach to prognathism.

Cordiner* describes the Siṇhalese as of a slender make, rather below the medium height, with slight but well-shaped

* Cordiner, *l. c.*, vol. I., p. 94.

limbs, and with regular features of the like form with the Europeans; their colour, although varying in shade, not so dark as that of the Indians on the continent; the eyes black, but the whites of them strikingly clear; the hair long, smooth, and black. Among the higher classes the complexion is so light that it seems lighter than that of brunettes in England. In all classes the inner surface of the hands and feet is uniformly white. Of the Kandyans Cordiner* says that they differ no more from the Siṉhalese than the mountaineers of other lands from the dwellers on the coast. They are of a stouter make and fairer complexion, but not taller. Their manners are less polished, and the custom of wearing a beard increases the natural wildness of their appearance.

If we compare these descriptions with those already given of the Veḍdás we find in reality but few points of difference. The complexion of the last may be on the average somewhat darker, but it varies apparently within the same limits. In regard to this the testimony of Dr. Davy especially is of the highest importance. The swarthiness which Mr. Bailey emphasises of the Veḍdás is to be ascribed at least in part to their lack of cleanliness. It is equally doubtful if the hair differs; put the well-dressed, carefully-combed, smooth hair of the Siṉhalese, which is only curly at the ends, beside the neglected, dishevelled, entangled, but not curly hair of the Veḍdás, which hangs down so far and sticks out all round, making the head appear very large, and one is inclined to conjecture that the difference here is owing to culture rather than to original peculiarity. The average height of the Siṉhalese seems to correspond to about the height of the tallest Veḍdá: they are somewhat shorter than Europeans.

Among the characteristics cited there is in reality only one which seems to have made a very decided impression on every observer, namely, the form of the nose, about which even the old Chinese furnish reports. Whilst with the Siṉhalese it is

* Cordiner, *l. c.*, p. 131.

very prominent, resembling an eagle's beak, and therefore rather thin and narrow, with the Vẹddás it is always described as flat, and with widely-distended nostrils. Add to this the thick and projecting lips and the large mouth, and perhaps also the comparative shortness of the Vẹddá face, there then remains, as Mr. Hartshorne* has already pointed out, only a few facial characteristics for diagnosis. Whether this is correct the future may teach us, provided exact descriptions (and above all large photographs) of the Vẹddás are furnished in time. Meanwhile we may state that the *Sinhalese also belong to a dark—perhaps best described as a brown—smooth-haired, and not (or only a very moderately) prognathous race.*

How is it now with the osteological indications? Literature in this regard offers somewhat more explicit statements, although exclusively for skulls. Here also it is the merit of Davy to have furnished us with exact information. He asserts the Sinhalese skull to be longer than the European. As proof of this he gives on Plate 3 the drawing, side and front view, of the skull of a Sinhalese chief from a secluded region inland. This skull is long, moderately high, with abruptly rising forehead, and broad, square back head, flattened at the sides up to the temples; the zygomatic arches prominent, the eye-cavities rather broad and low, and tending to square, but widening towards the bottom and the outside; the nose narrow and prominent, with bridge slightly bent in; the face short, with a low, slightly projecting upper jaw.

A more recent description of a *cranium Cingalensis* is given by Gerard Sandifort.† The skull was furnished by Van Hassem an Brugmans, and is at present in the Anatomical

* Hartshorne, *l. c.*, p. 409, says: "The general appearance of the Weddas may be described as distinctly non-Aryan. The comparative shortness of their thumbs and their sharply-pointed elbows are worthy of remark, as well as their flat noses, and in some cases thick lips, features which at once distinguish them in a marked degree from the Oriental races living in their vicinity."

† Gerard Sandifort. Tabulæ Craniorum Diversarum Gentium. Lugduni Batav. 1838 (*c. f.* Mus. Anat. Acad. Lugd. Bat., 1827, vol. III., p. 39, No. DLXXXIV.).

Museum at Leyden. There is also a great number of measurements given, but unfortunately the greater part of them are of no use for our purpose. The capacity is stated at 39 ounces of millet. Judging from the picture it is a very powerful skull, with a long, strong face, very prognathous, having large, very prominent teeth, large and broad lower jaw, the nose long, high, and thin, the eye-cavities low, imperfectly rounded, and very much aslant. As their height is given at ·031, the breadth at ·041, the orbital index 75·6 would be chamaekonch. The inter-orbital distance is mentioned as ·024. The author himself describes the cranium as oval, with a very high crown, sides very much flattened, with slightly projecting *tubera*, the back head oblong and by no means spheroid, the under parts rather flat; the eye-cavities oblong in the tranverse axis, the *fissura orbitalis posterior* wide, the ends (*vertices*) of the upper jaw hollowed out (*excavatus*), on the lower rims cut out (*exsectus*), and passing obliquely into the likewise oblique and projecting alveolar process of the maxillary bone; the palate much arched (*fornicatum*) and oblong. I remark that its length is stated at ·059, its breadth in the region of the third molar at ·041, in the regim of the præ-molars at ·039; out of the first two measures would result a palatal index of 69·4: consequently an extremely leptostaphyline measure, which indeed does not afford an exact comparison with my measure taken in the region of the second molar. The vertical height of the skull is stated at ·145, the tuberal parietal breadth at ·126, the jugal breadth at ·138, and the distance of the maxillary angle at ·110.

I find another statement in the catalogue of the Vrolik Museum in Amsterdam,* where, under No. 66, is mentioned the skull of a native of Ceylon, which Professor Bernard had furnished. It is compared with the *cranium Cingalensis* of Sandifort, from which it is said to be distinguished chiefly by its less prognathous jaw. It is described as a fine, strong, dolichocephalous and somewhat prognathous skull, the

* Musée Vrolik. Catalogue par J. L. Dusseau. Amsterdam, 1865, p. 22.

forehead long, but of little height, considerably flattened at the sides, the cheek-bones strong, and all the muscle *epiphyses* well developed. From the measures given we calculated an index of ratio between length and breadth of 72·2, between length and height of 75, and a palatal index of 73·7.

Mr. Welcker * gives in his craniological tables the average index figures for five Siṉhalese skulls, without, however, saying where these are at present to be found ; probably the above-mentioned Dutch specimens are among them. He states the breadth to be 73·4, the height 77·2.

A large number of Siṉhalese skulls are brought forward by Mr. Davis, † in fact, a whole dozen. One of these, however, is expressly said to be probably a hybrid of Malabar and Siṉhalese, and must therefore be excluded. Of the remainder one is from Panaduré, one from Kandy, one from Negombo, one from Colombo, the others unascertained. Half are male and half female. The one (No. 982) which is called klinocephalous and has a *processus papillaris* before the opening of the back head, according to Mr. Davis shows "a degree of mikrocephaly," but as its capacity amounts to 1,474·6 cub. cm. we are not quite justified in such an assumption. I give below a short list of the main results obtained :—

The number of the skull.	Capacity.		Index of Longitudinal Breadth.		Index of Longitudinal Height.	
	♂	♀	♂	♀	♂	♀
315 ...	—	1175·7	—	72	—	70
979 ...	—	1394·9	—	74	—	78
980 ...	1235·5	—	76	—	84	—
981 ...	—	1355·1	—	75	—	74
982 ...	—	1474·6	—	65	—	72
983 ...	—	1494·6	—	70	—	80
984 ...	1673 9	—	75	—	76	—
1007 ...	1614·1	—	72	—	70	—
1008 ...	1693·8	—	73	—	74	—
1009 ...	1275·4	—	72	—	76	—
Medium ...	1498 5	1378·9	73·6	71·6	76	74·8
Total average 10)...	1438·8		72·4		75·4	

* Archiv. für Anthropologie, 1886, Bd. s. 154, 157.

† J. Barnard Davis. Thesaurus Craniorum, p. 132.

The average indices agree very nearly with the indices of the skulls in the Vrolik Museum. Dolichocephaly is very pronounced, though not so strongly as with the Veḍḍás; the height agrees pretty well with the Veḍḍás, but the capacity is much greater.

A wholly different description of the skull of a Siṇhalese is given by Mr. Zuckerkandl.* This skull was brought over by the Novara expedition without any statement whatever of its origin. It has a capacity of 1,505 cub. cm., and an index of ratio between length and breadth of 86·1. It is therefore hyper-brachycephalous. We may assert without hesitation that it is either in a high degree pathological or outright not the skull of a Siṇhalese. The latter assumption is supported by the fact that the incisors and canine teeth of the upper jaw are filed flat,—a phenomenon nowhere mentioned as seen among the Siṇhalese, but which points very clearly to a Malayan origin. The assumption of a pathological, perhaps deformed formation, is supported by the fact that the cranium is asymmetrical, the forehead flat and retreating, while the *squama occipitalis* is pressed flat to such a degree that the upper half is sunk in "almost in the form of a wave." We may therefore exclude this skull from comparison.

With regard to my own skulls, I have already said that probably a child's skull, marked as Siṇhalese, will have to be excluded; but as it is so distinctly stated to be Siṇhalese I will here describe it with the rest.

Skull No. 1 (Table II.).

A juvenile male skull, seemingly rather large, but without under jaw. *Synchondrosis spheno occipitalis* closed. Wisdom teeth broken out; the front teeth have later fallen out; the remaining molars and the first premolars are very large, and only a little worn on the crowns, but covered with a thick black crust (betel). The points of attachment of the

* Reise der Osterreichischen Fregatte Novara. Anthropologischer Theil. Erste Abtheilung. Cranien der Novara Sammlung, beschrieben von E. Zuckerkandl. Wien, 1875, s. 24.

muscles strong, but the frontal eminences not very prominent. The bones are yellow-brown, smooth, shiny, and hard.

The skull is in reality smaller than it appears ; it has only a capacity of 1,110 cub. cm. The index of ratio between length and breadth is 71·3, and is strongly dolichocephalous, between length and height 72·5, orthocephalus.

In the *norma verticalis* the roof of the skull appears long and narrow, tapering toward back and front, moderately phænozygomatic, the *tubera parietalia* spreading out broadly. The skull is unsymmetrical (plagiocephalic), especially behind and below, where upon the left side, but still on the parietal bone, there is to be observed an oblique flattening, whilst the right side is more fully rounded out. In front the form is more regular, although the right half of the forehead is somewhat awry, and the right zygomatic arch shorter than the left ; the nose diverges a little to the left, and the palatal suture at the back part turns a little to the left. The sagittal suture, also, is not exactly median. Many signs are visible of premature *synosteosis :* thus, on either side, but more extensively on the left, in the midst of the side parts of the coronal suture, and at different points of the sagittal suture, of which the right emissary is wanting and the left very small. The lower side parts of the coronal suture are quite obliterated on the left for a length of 30 mm., and on to the right of 22 mm. The open sutures are comparatively simple, yet the sagittal suture in its middle, and the lambdoidal suture, have pretty large and broad indentures. The latter at the point is very much depressed, and at the sides, especially the left, there are several wormian bones. On either side, in the region where usually the *sutura transversa occipitis* begins, we find a wormian bone reaching to the parietal bone, larger on the left side, but in its middle and upper part synosteotic.

In a lateral view of the skull it appears long and low, the brow itself low and rather sloping, the *tubera frontalia* only tolerably distinct, the front of the skull long and

rising abruptly. It reaches its height at the coronary suture ; behind this is a slight depression ; the vertical height, a finger's breadth behind the *coronaria*. The back slope of the parietal curve begins in the region of the *tubera*, and is very long ; the *squama superioris* is strongly convex. The temporal *fossæ* large, and reaching to the *tubera parietalia*, and beyond the lambdoidal suture. The front part of the temporal *fossæ* uneven and rugged. The *squama temporalis* on either side flat and high, especially on the left. On either side a strong *processus frontalis*, which is only somewhat indistinct because of the extensive *synosteosis* of the *coronaria*. The *ala temporalis* low and quite overlaid by the very broad process, which extends from the *squama temporalis*, pretty regularly on the right, somewhat jagged on the left, but on both sides pointed in front. In consequence of this stenokrotaphy we find, however, that the very much depressed place is pretty low down upon the *ala*, indeed, immediately at the juncture of the *sutura spheno frontalis*, *zygomatico frontalis*, and *spheno zygomatica*. The process appears more pointed on the left, on the right almost trapezoidial. The measures amount to :—

		Right.		Left.
Length of *proc. temp.* upper	...	15 mm.	...	12 mm.
Do. under	...	10 mm.	...	9 mm.
Breadth of *ala temp.* ...	...	19 mm.	...	18 mm.

In the *norma occipitalis* the contour of the skull is almost pentagonal, the side parts going almost straight down, only diverging at the base, the roof with slightly arched lateral parts, the base tolerably straight. The *squama superioris* strongly prominent and flattened at the sides. No *protuberantia occipita externa*. The *linea semicircularis superior* and *inferior* strongly marked : *linea suprema* very faint. We find on either side, however, and especially strong on the left, a deep abrupt break between the *facies muscularis* and the *facies laevis*, which in its lower part follows the direction of the *linea superior*, then makes a deep bend toward the mesial line, and ends parallel to the *linea suprema*, right underneath it. In this way is formed on either side a long

deep-lying tongue of the *facies laevis*, which reaches the *sutura transversa.* The cerebellar *fossæ* are tolerably rounded out, the *facies muscularis* more deeply marked. No large *emissaria mastoidea*, but instead of this a larger *foramen* on either side, near the *crista perpendicularis.* The *foramen magnum* is rounded posteriorly, more oval anteriorly, 31 mm. in length, 26 in breadth, therefore 83·8. The articulation prominent and bent; *processus mastoides* poorly developed, with a deep depression; *processus styloides* large. *Apophysis basilaris* lying somewhat flat; *processus pterygoides* with spreading *lamina externa;* deep *fossæ* for the lower jaw.

In the *norma frontalis* the middle and anterior part of the head seems high, the region of the fontanelle raised, the face, however, short and narrow. Orbits low and almost four-cornered; index 76·9, therefore strongly chamaekonch. *Fissura spheno maxillaris* spreading out in front. The outer edge of the orbits bent inwards a little just below the *sutura zygomatico frontalis*, inasmuch as here the *processus frontalis* of the malar bone is somewhat bent inward posteriorly. The nose low, narrow above where it articulates with the broad nasal process of the frontal bone, the bridge bent in and somewhat rounded, but prominent and aquiline, the aperture broad below, narrow above, hence triangular; index 57·7, therefore platyrrhine; *canine fossæ* full, *foramina infraorbitalia* large, and especially the left one, communicating with a roundish depression on the surface of the *canine fossa.* Alveolar process short, in the middle 13 mm. long, obliquely prominent. *Alveolæ* broad, palate large, especially long; index 75·4, therefore leptostaphyline. The *sutura transversa palati* very much forward, 17 mm. in front of the *spina nasalis posterior*, which is short and rounded away. The alveolar process is widely curved in front, almost straight at the sides, slightly converging behind. Hence the palate long, of prognathous character, and somewhat pithecoid in form. The malar bones on both sides have a fissure posteriorly beginning at the *sutura*

zygomatico temporalis, 6 mm. right, 5 mm. at the left, and 3 *foramina zygomatica*. The *tuberositas molaris* is of moderate size, and belongs mainly to the upper jaw; the *tuberositas marginalis temporalis*, especially the left, is very strongly developed, and the bone very much bent inward below.

Skull No. 2.

A senile, wholly toothless, probably male skull, without lower jaw, of very moderate capacity (1,200 cub. cm.), but strongly dolicho-orthocephalic (ratio of length and breadth 70·2, of length and height 73·2).

It shows throughout a tendency to *synosteosis;* the sagittal suture is wholly obliterated—not a trace of it; in the region of the fontanelle a broad projection above the frontal bone, as sign of early obliteration. The *emissaria* are present, but very near together (distance 10 mm.), the right considerably enlarged. The coronal suture obliterated in the lower part to a considerable extent on the right; on the left it is perfectly simple, and in process of obliteration. At the right the posterior part of the *spheno frontalis* is overgrown; the *spheno parietalis* on both sides indistinct. The lambdoidal suture at its angle shows traces of obliteration.

In the *norma verticalis* the skull is very long and narrow, strongly arched in front, narrowed behind, with very prominent lambdoidal angle, for the rest phænozygomatic. The tuberosities very broad and prominent, therefore somewhat klinocephalic in form. At the right, on the parietal bone, just behind the coronal suture, several flat *exostoses.*

In the *norma temporalis* the skull appears rather long than high. The middle of the parietal curve is flat, its frontal division strongly arched, the posterior obliquely sloping downward to the lambdoidal angle; then, however, much arched at the *squama superioris.* Eminences rising even to the parietal prominences and the lambdoidal suture. *Squama temporalis* flat. *Alæ* depressed towards the centre, especially the right one, which is very much narrowed

below. At their extremities posteriorly an irregular, trapezoidal *epiptericum*, 11 long, 8 high, with indented edges, which towards the front are somewhat indistinct. The *angulus parietalis* is very short, and as far as can be judged with the *synosteosis* of the lower part of the coronal suture, and the adjoining part of the *spheno frontalis*, is prevented from coming in contact with the *ala* up to a distance of 4 mm.

	Right.		Left.
Direct breadth of the *ala sphen.* above ...	21 mm.	...	24 mm.
Do. do. below ...	12 mm.	...	15 mm.

The *norma occipitalis* shows very high straight sides, with simple flattened arching of the roof, and a straight base. Lambdoidal sutures jagged. *Squama superioris* strongly arched, but short, somewhat flattened laterally and below. Plainly marked *linea semicircularis suprema.* At the upper end of the *crista perpendicularis* a large irregular protuberance, very deep depression below the *lineæ semicirculares superiores.* Large cerebellar archings with depressions between well-developed *emissaria mastoidea.*

Basis cranii long, and protruding behind. Mastoid process small, with deep fissures. The *foramen magnum* small, 31 mm. long, 28 mm. broad, index 90·3, very prominent articulating surfaces, very long and strong styloid processes. In the centre of the basilar *apophysis* a large basilar *foramen* entering obliquely posteriorly, which corresponds to a deep irregularly sinuous *sulcus* on the surface of the *clivus Blumenbachii*, which, above and at the left, seems to have communicated with the *sinus cavernosus.* Deep and wide articular surfaces for the under jaw, very large *laminæ externæ* on the alar processes, especially on the left. At the left a very large *foramen ovale.*

From the front the middle of the head appears high and broad, the face delicate, short, and broad. The orbits rather high and oval, widening somewhat as well to the inner and upper, as to the outer and lower aspect, yet almost four-cornered ; index 82·9, therefore mesokonch. Remarkably wide *fissura spheno maxillaris.* The nose narrow above as well

as below, the bridge very prominent, bent in at the middle, almost aquiline ; index 46, therefore leptorrhine. The *sutura naso frontalis* fits convexly above into the nasal process of the frontal bone. *Spina anterior* and *inferior* well developed and prominent ; *crista* and *septum* very thick. On the cheek-bone either side a short indication of a posterior fissure, which, however, lies very high ; on both sides three small *foramina zygomatica.* Canine *fossæ* are little depressed, but, on the other hand, run from the immensely broad *foramen infraorbitale* on either side to the alveolar process, which is more strongly developed on the left, making a very deep fissure. The alveolar process is entirely toothless, but there are still single open *alveoli*, especially at the left in the region of the bicuspids and first molars ; most of the *alveoli*, especially those of the incisors, are entirely obliterated, and the process has disappeared, so that the shape of the very much shrunken palate is uncertain. Here also the position of the transverse suture is remarkable, because it is pushed so far to the front as to be at a distance of 14 mm. from the posterior edge. The *spina nasalis posterior* is wholly wanting; a short bifid projection larger on the left than on the right.

Skull No. 3.

A child's skull, perhaps female, with the not yet exchanged milk teeth. The outer upper cutting teeth are still enclosed in their cavities. The *sutura incisora* of the palate very plain. The bicuspids and first molars developed, and very large. The first bicuspids with three fangs, two outer and one inner, the right one, moreover, with an *exosteosis* of enamel. The *alveoli* of the second molars are open very wide, and empty, but the teeth, to be sure, had not yet erupted. The openings of the *alveoli* of the wisdom teeth still lie very deeply, and far back. The *synchondrosis spheno occipitalis* very widely open. To the right, at the *squama occipitalis*, is a *sutura mendosa* 24 mm. long, in the direction of the *sutura transversa ;* at the right only a slight indication of one.

Notwithstanding youth, this skull is larger than the two

preceding ones; its capacity amounts to 1,250 cub. cm., therefore it is mesohypsicephalic (ratio of length and breadth 76·7, of length and height 77·3): therefore in its form it is wholly irregular.

Looked at from above it appears cut off short behind and somewhat unsymmetrical; broadly arched in the region of the parietal eminences, towards the front lessened, but still more broad. It is scarcely phænozygomatic. The sutures are open, but the lower parts of the coronal and the posterior division of the sagittal are very simple. The left *foramen parietale* is obliterated up to an almost invisible point, the right distinct, but moved very near to the suture. The lambdoidal has deep indentations with wormian bone near the angle, and in the vicinity of the side fontanelle. Parietal and frontal emissaries broadly prominent.

At a side view the skull has a wholly female form; the low brow passes with a sudden turning into the long slight parietal curve, from which, posteriorly, there is a very sudden fall, with slight arching of the *squama superioris*. Yet the skull appears high. In the right temporal region is a very large *epiptericum*, 25 mm. long, 10 mm. high, obliquely quadrangular. This completely interrupts the union of the *ala* with the *angulus parietalis*, at the expense of which it is principally developed. The ring is depressed, and in its middle part shows stenokrotaphy. To compensate, the temporal part of the frontal bone is arched forward, bomb-shaped on the left. The conditions are almost normal; but here also is an arching of the orbital portion of the frontal bone, and the *ala* is set more deeply into the latter:—

	Right.		Left.
Breadth of the *ala* above ...	13 mm.	...	20 mm.
Do. in the middle	10 mm.	...	12 mm.

At a back view the skull is very high and broad, the sides straight, slightly converging below, the roof slightly rounded. The back part of the head high, the *squama superioris* arched out, almost like a ball. No protuberance, *linæ semicirculares* scarcely visible. Cerebellar archings well developed over

the *sutura mendosa*, a deep transverse impression (einschnürung ?) which in a manner cuts off the ball-shaped *squama superioris*, and is deepest at the lambdoidal suture.

A view of the skull from below gives the impression of breadth, principally in the mastoid region, whilst the laterally narrowed and very small occipital part seems rather long. The mastoid processes small, with a deep fissure. *Foramen magnum* very large, especially long and posteriorly—in the middle of the border having a secondary curving out (indication of *spina bifida occipitalis ?*) ; on either side in front of this a thickened place forming a smooth articulating surface, evidently for the reception of the ring of the *atlas*. Length of the *foramen* (with the curving out) 36, breadth 25.

From a front view is seen a low, broad forehead, with very distinct eminencies and large nasal process. At the lower part of the latter a short remnant of the frontal suture. The orbits high and large diagonally, widened above and outwardly ; index 83·3, therefore mesokonch. The root of the nose broad and somewhat flattened, the bridge slightly arched and short, bent forward and downward at the end ; the *sutura naso frontalis* flat, and only slightly projecting above the plane of the *sutura maxillo frontalis*. The aperture high and triangular, with rounded corners ; nose index 55·5, therefore platyrrhine. Alveolar process not at all prognathous, but the teeth somewhat obliquely directed forward. Palate short and broad, almost the shape of a horse-shoe, with a large (17 mm. long, from front to back) palatal plate ; index 86·8, therefore brachystaphyline. The curve of the teeth short and wide, diverging behind.

From this description it is manifest that the last of the three skulls differs in the chief respects from the two others, and it is easy to understand that this difference would have become very much greater if the child had lived and completed its development. It will appear later that in these main points it approaches the skulls of the Tamils, although these, among themselves, present no small differences. I

will not go quite so far as to declare outright that it is a Tamil skull, but it may have belonged to a bastard, and the fact (already mentioned) that the skull No. 316, from Mr. Davis's collection, which is distinctly marked as that of a hybrid of Malabar and Siṇhalese, corresponds with this one almost entirely in the indices (ratio of length and breadth 77, of length and height 78), speaks strongly in favour of the assumption. It would seem at least wiser for the present to exclude it from the collection. But I may at the same time add that the same reasons may be urged against the admission of the skull No. 980, from Mr. Davis. This has a ratio of length and breadth 76, and an index of height 84, although it belonged to a senile individual, with total disappearance of the alveolar processes. If then we withdraw this, as well as my skull No. 3, there remains tolerably homogeneous material, which offers great probability that it fairly corresponds to the typical conditions. To the support of this view the fact is of value, that the drawings which Davy, and even those which Sandifort has given, coincide not only with those I have furnished (Table II.), but also, in the main, with all the other descriptions and measurements. Nevertheless I am sorry to say that the existing material is nowise sufficient to enable us to decide all the questions. The absence of the lower jaw in all my skulls is a very serious loss, and the senile condition, as well as the extensive *synosteosis* of one of the two apparently pure skulls (No. 2), makes even the use of this, in regard to all the points in which it varies, questionable. Even the third still remaining skull (No. 1) is not free from great and plainly individual aberrations, for it not only shows, in spite of the youth of its owner, very numerous obliterations, but also on either side a large *processus frontalis squamæ temporalis.*

This discussion is in the highest degree instructive, as showing how unsafe it is to make race definitions on the ground of single, or of a few skulls, and how necessary it is, especially for such complicated ethnological conditions as

those of Ceylon, to have ample and historically sure material at our disposal. In the present case, I consider myself justified in not foregoing the use of the skulls sent to me, because through the comparison with the skull measurements from other collections I have sufficient material under control afforded me. Setting aside the not measured but simply represented skulls in Davy's work, and also those of Mr. Welcker (five) mentioned without any detailed statements, and Sandifort's skulls given with a wholly different method of measurement, we can use for our comparison twelve Siṇhalese skulls, viz., one from the Vrolik Museum, nine from Mr. Davis's collection, and two from mine. These would make a good broad basis for the decision, if important numbers were not lacking in Mr. Davis's: for instance, measures of the orbits, of the nose, and of the palate. Hence my work in several respects can only serve as preparatory.

Our study of details thus far has proved, first, that the Siṇhalese skull is considerably larger on the average than the Vẹddá skull. Leaving out the two doubtful ones from nine skulls of Mr. Davis's, and two of mine, we obtain an average of 1,406 cub. cm., which exceeds the measure of the Vẹddá average by 145 cub. cm. To be sure, the fluctuations here also are very great: the extremes of 1,110 and 1,694 cub. cm. afford a difference of 584, almost as great as we meet with among the Vẹddás. A comparison of them, however, immediately shows that the numbers much more frequently range high among the Siṇhalese :—

cub. cm.		Vẹddás.			Siṇhalese.	
901–1,000	...	1	15	...	—	4
1,001–1,100	...	1		...	—	
1,101–1,200	...	3		...	3	
1,201–1,300	...	10		...	1	
1,301–1,400	...	2	5	...	2	7
1,401–1,500	...	2		...	2	
Over 1,600	...	3		...	3	

Corresponding to the greater capacity, the measurements are also larger with the Siṇhalese.

And first, for the extent horizontally I have, in like manner, as with the Veddás, after putting the figures of Mr. Davis into metre measure (leaving out here also the skull No. 980), received as an average of—

4 Male skulls	...	...	532 mm.
5 Female skulls	...	...	494 mm.
9 Sinhalese skulls	...	...	511 mm.

Compared with the Veddá skulls of Mr. Davis, the difference in favour of the Sinhalese amounts to 26·11 and 23 mm. My two Sinhalese skulls, whose small capacity is clear from the previously given numbers, show only 482 and 493 mm. extent horizontally: consequently, in the one case it is somewhat less and in the other somewhat more than the average of the Colombo skulls which I measured. On the other hand, the size vertically (398 and 293 mm.) proved greater with my Sinhalese than the average of the Colombo skulls (298 mm.). One of the latter, however (No. 5), has a higher measure (300 mm.). In the average, the vertical compass of my two Sinhalese skulls is 192 mm. less than the horizontal, of which it is 60·5 per cent.; therefore somewhat more than with the Veddás.

I have likewise calculated the length of circumference of Mr. Davis's skulls, taken with the sagittal suture. I receive an average from—

4 Male skulls	...	...	393 mm.
5 Female skulls	...	...	370 mm.
9 Sinhalese skulls	...	...	380 mm.

whilst my own measurements amount to 354 and 365 mm. The corresponding average with the Veddá skulls amounts to 366 (Davis) and 355 (Virchow) mm.

As regards the single segments of the sagittal arch, I find the following average from Mr. Davis's figures :—

	Frontal.	Parietal Segment.	Occipital.
4 Male skulls	... 136 mm.	... 136 mm.	... 120 mm.
5 Female skulls	... 128 mm.	... 131 mm.	... 110 mm.
9 Sinhalese skulls	... 132 mm.	... 133 mm.	... 115 mm.

or, according to the per centage of the whole sagittal arch :—

4 Male skulls ...	34·6	...	34·6	...	30·5
5 Female skulls...	34·5	...	35·2	...	29·7
9 Sinhalese skulls	34·7	...	35·0	...	30·2

Here, as contrasted with the Veddás, we notice in a very striking way the important part taken by the frontal and parietal bones, especially the first, and the insignificant part, on the contrary, assigned to the occipital bone.

With my two skulls the proportions for the middle of head appear most favourable, and therefore rather according to the female type of Mr. Davis's skulls :—

No. 1	...	33·6	...	35·3	...	31·0
No. 2	...	33·9	...	35·6	...	30·4

The proportion of the sagittal vertical extent to the horizontal amounts in Mr. Davis's skulls to 74·3, in mine to 73·7 : hence almost the same numbers as with the Veddás.

As regards the form of the head, I have already given the particulars of Mr. Davis's skulls. The ratio of the average of length and breadth is, according to index, the following :—

		Skulls.		
Dusseau ...	...	1	...	72·2
Davis ...	...	9	...	72 0
Virchow ...	...	2	...	70·7
On the whole, from	...	12	...	71·8

This excellent dolichocephalous measure accords almost exactly with the Veddá average (71·6). Even if we take into consideration the five skulls measured by Mr. Welcker, and omit the one mentioned by Mr. Dusseau, the average for sixteen skulls only amounts to 72·2. I will not lay any particular stress upon the difference in sex, since even with the Veddás contradictory numbers have been shown. I can only say authoritatively that Mr. Davis's figures for the female Sinhalese heads show a smaller proportion (71·2) than those of the men (73). But here I must say that the previously described skull (No. 982), which Mr. Davis, for some reason

not apparent, calls mikrocephalic, has only an index of 65. Omitting this one we get from Mr. Davis's four female Siṉhalese skulls an average index of 72·7.

It is especially noteworthy that all the particularised Siṉhalese skulls (with the exception of skull No. 980 belonging to Mr. Davis, several times mentioned, but left out of the computation) vary within the limits of dolichocephaly, whilst among twenty Veḍdá skulls (even after the exclusion of the deformed one) there were found four mesocephalic. Were we perfectly sure of the correctness of the preceding statements, we must infer from them certainly a special similarity of the Veḍdá race to the Siṉhalese.

As regards the proportions of the single parts of the skull to the length of the whole, I have made a like calculation to that of the Veḍdás :—

		No. 1.		No. 2.
Index (*a*)	...	29·7	...	29·8
Index (*b*)	...	55·6	...	53·5

On the whole, these measures also are somewhat greater than with the Veḍdás, while yet nowise in a constant or characteristic way.

The absolute figures for the greatest length and breadth of the skulls on the whole run higher for the Siṉhalese than for the Veḍdás. I will next give a list of the length, breadth, and height measures of all the Siṉhalese skulls :—

			Length. mm.		Breadth. mm.		Height. mm.
Dusseau ...		...	180	...	130	...	135
Davis,	No. 315	...	172·7	...	124·5	...	121·9
	„ 979	...	177·8	...	132·1	...	139·7
	„ 981	...	175·2	...	132·1	...	129·5
	„ 982	...	182·8	...	119·4	..	132·1
	„ 983	...	180·3	...	129·5	...	144·8
	„ 984	...	193	...	144·8	...	147·3
	„ 1,007	...	195·6	...	142·2	...	134·6
	„ 1,008	...	198·1	...	144·8	...	147·3
	„ 1,009	...	182·8	...	132·1	..	139·7
Virchow, No.	1	...	178	...	127	...	129
„	2	...	181	...	127	...	132·5

We see from these that the greatest length of three male skulls is over 190 mm., and of only four skulls (chiefly female) less than 180 mm. Of the twelve skulls, seven have a length of over 180 mm. The Siṇhalese skulls, according to this, exceed the Veddá skulls in length. The result is the same with the greatest breadth. Of the twelve skulls half show a breadth of over 130 mm., three are over even 140 mm. in breadth, only five are under 130 mm.

As regards the vertical height, it is the same with the Siṇhalese as with the Veddás, and greater on the whole than the greatest breadth. Only with three (two female and one male) does the breadth exceed the height. On the other hand, in two skulls of women the height is considerably greater than the breadth, viz., about 12·7 and 15·3 mm. In three cases the height reaches a measure over 140, rising in one to 144·8 and in two to 147·3 mm. This is considerably more than with the Veddás. Nevertheless, the ratio of length to height reckons for :—

	Index.	Males.	Females.
Dusseau ...	(1) ...	75·0 ...	—
Davis ...	(4) ...	74·0 ...	(5) 74·8
Virchow ...	(2) ...	72·8 ...	—
Total ...	(7) ...	73·8 ...	(5) 74·8
Average of the whole twelve		...	74·2

The result, therefore, is a little below the average of the Veddás (74·9), and within that of orthocephaly. The figures given by Mr. Welcker (77·2) exceed considerably the above estimate ; but if we include them in taking the average, and leave out the estimates of Dusseau, the result obtained for sixteen skulls is 75·1, which is only a minimum over the amount of the Veddá index.

The auricular index is likewise less than with the Veddás (63·5 and 58·5)—in the latter case less than with any of the Veddás.

The total result as regards the formation of the skull is, hence, *that a great correspondence exists between the proportions of the Siṇhalese and the Veddás, while the absolute*

figures show the Sinhalese to exceed the Veddás, as a rule, in height. These differences would in the average be of still more importance if the two skulls I have measured had not suffered from a great variety of impediments to their perfect development. I therefore call attention to the description, and will here only say that there is certainly premature *synosteoses* and much irregularity in the temporal region, especially in the one case, where there is stenokrotaphy, and where the squamous portion of the temporal bone overlaps the frontal bone; and in the other case owing to a great *epiptericum.*

In the latter condition was also found the Veddá skull from the Colombo Museum; and a Veddá skull from the London Museum shows (as before mentioned) stenokrotaphy.

In examining the form of the face, I follow the same method as before with the Veddás, and begin with the orbits.

Unfortunately, a great difference appears in the orbital index of the two skulls I measured, which it is difficult to reconcile, the first being 76·9 the other 82·9—consequently, one chamækonch the other mesokonch. The last will therefore correspond nearer to the Veddá skulls. Here I must suspend judgment, for no other observer has recorded orbital measurements of the Sinhalese, or made any statements about the shape of the orbits. Whether the shape which I have spoken of as inclining to quadrangular is of any significance, must be decided by further observations.

It is the same with the nose index. In the first of my Sinhalese 57·7, therefore platyrrhine; with the second 46, therefore leptorrhine. Like differences are found, to be sure, in the Veddá skulls, whose average shows a mesorrhine measure (52·2), while we might have expected, according to the descriptions of the observers before quoted, a greater uniformity in the shape of the nose. The bony structure of the nose in the Sinhalese skulls is narrow, prominent, and with a slightly aquiline bridge; and I have the impression that the form, as it exists in skull No. 2, is really the typical

one. I have earlier expressed my idea* about a form which is determined by two wholly different factors, not necessarily united to one another, viz., the height of the nose and the breadth of the aperture. But it is not worth while to continue this discussion at present, with so little material.

Only six of Mr. B. Davis's skulls offer material for determining the index of the face, and of these five are female. I have computed them as follows :—

Skulls.		Height of whole Face. mm.		Transverse Diameter. mm.		Index.
No. 315 ♀	...	109	...	114	...	95·6
„ 979 ♀	...	91	...	117	...	17·7
„ 981 ♀	...	104	...	117	...	88·8
„ 982 ♀	...	102	...	125	...	81·6
„ 983 ♀	...	117	...	127	...	92·1
„ 1,007 ♂	...	130	...	132	...	98·4

Here a very considerable contrast appears to the Vẹddás. Whilst the highest measure of the male Vẹddá was 88·2, with the Siṇhalese we have a male skull of 98·4 and two female skulls of 92·1 and 95·6 ; a third female skull has an index of 88·8. There remain only two female skulls with low measures, one 81·6 and one of a weak-minded person, which is 77·7. Whilst the total average with the Vẹddás was only something over 83, I find for the Siṇhalese 89.

If we now reflect that of the female skulls, as a rule, the measure is lower, and that here, of six skulls, five are female, among which is included the abnormally low measurement of the skull of a weak-minded person, we may assume as very probable that the Siṇhalese face index in the classification suggested by Mr. Kollmann (which, however is based upon a somewhat different computation) is leptoprosopic. The smallness of the yugal distance is decidedly in favour of such an assumption.

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* Virchow. Beiträge zür physischen Anthropologie der Deütschen mit besonderer Berüchsichtigüng der Friesen. Abhandlungen der Akademie. Berlin, 1876, s. 143, 350.

Since in both my skulls the lower jaw is wanting, I cannot arrange a corresponding calculation. Added to this, one of them is so greatly changed on the edge of the jaw by age, that it could not even be used for the middle face index. I can therefore simply institute a comparison between one Veḍdá skull (No. 1) and one Siṇhalese. In the following I give an index (*a*) calculated from the proportion of the height of the middle face (root of the nose to the alveolar edge) to the zygomatic diameter, the latter = 100; and a second (*b*) calculated from the same height, and from the molar breadth (lower end of the *sutura zygomatico maxillares*), the last = 100:—

		(*a*)		(*b*)
Veḍdá	...	50·0	...	70·1
Siṇhalese	...	52·6	...	60·5

Here the result is, as before, less breadth of the whole face with the Siṇhalese, but greater width of front face. The alveolar index of the Siṇhalese No. 1 shows a comparatively high figure, viz., 99, but the facial angle (external meatus, nasal spine, root of the nose) only 75, whilst in the case of the Veḍdás amounting to 82.

With regard to the palate, I have unfortunately neglected to take the measure of it in the Veḍdá skull. I have, however, stated that it was broad, and the alveolar ridge in the shape of a horse-shoe. Contrasted with this, the Siṇhalese palate exhibits considerable difference. According to Dusseau's figures, I reckon a palatal index of 73·7; according to mine, for skull No. 1, of 75·4. Result, a leptostaphyline measure. If we compare the two skulls upon Tables I. and II., below fig. 5, the difference is obvious. Whether it is to be regarded as universal I am not able to say.

On the whole, the osteological investigation of the Siṇhalese face, therefore, confirms what has already become conspicuous from the physiognomical observations of individual reporters; *the skeleton face of the Siṇhalese differs far more from that of the Veḍdás than the skull of the former from that of the latter.* It is distinguished, as a whole, in that it is much

narrower. The same is true of the palate, and probably of the nose. On the other hand, the orbits—at least of my Siṇhalese skull—are by no means high. The greatest uncertainty is regarding the form of the jaw-bone. One Siṇhalese skull I have pictured on Table II. is decidedly more prognathous than the Vẹddá skull, Table I., but also more than the Siṇhalese skull, according to Davy. The Vẹddá skull of Messrs. Quatrefages and Hamy, as well as the Siṇhalese skull of Sandifort, has, however, a very prominent alveolar process.

Before pursuing this comparison farther it will be expedient to discuss the other races of people who must later on be brought into comparison.

The Tamils or Malabars.

As already explained, we understand by this name the Dravidian immigrants who, in historic time, came from many different points on the peninsula of Hindústán, and in the course of over two thousand years multiplied so greatly that they almost exclusively peopled the north and a large portion of the east of the Island, more especially along the coast. When the Portuguese, the first pioneers of European civilisation, obtained a firm foothold upon the Island, the Malabar rule was firmly established in the old *Rájaraṭa*, or *Pihiṭiraṭa*. Moreover, Valentijn* defines their seat in his time as extending up to the river Corunda Waye, which it seems is identical with the Koorinda, or Kirinde-oya ("cinnamon river"), of Sir E. Tennent,† a little river which toward the south-east, near Mahágan, empties itself into the sea. Davy‡ also designates the northerly and eastern coast provinces as the principal seats of the Malabars.

Pridham§ speaks of them as inhabitants of the land from Batticaloa even to Jaffna in the north, and from there as far

* Valentijn, *l. c.*, Bl. 49.
† Tennent, *l. c.*, I., p. 41; II., p. 417.
‡ Davy, *l. c.*, p. 108.
§ Pridham, *l. c.*, p. 463.

south as Puttaḷam. It is not to be understood from this, however, that they live even now wholly separated from the Siṇhalese. On the contrary, they are found in no small numbers mixed with other races, especially in the towns, as the description of Colombo by Sir E. Tennent* very clearly testifies. In this city they form a large fraction of the labouring population. It is of special interest to us that in the east they are immediate neighbours of the Veḍdás.

In fact Wolf,† who found no sort of resemblance between Malabars and Siṇhalese, calls the Veḍdás "another species of Malabar." He describes the Malabars as black, long-haired, and without calves to their legs. Beyond this I find very few statements regarding their physical peculiarities. Most of the writers limit themselves on this point to ascribing to them a stouter physique and greater activity than the Siṇhalese.‡ Mr. Pridham says they either wear the hair carelessly fastened up in a coil upon the crown of the head, or on one side above the ear; sometimes the whole head is shorn with the exception of a single lock upon the crown. Sir E. Tennent§ describes the children of the Tamils as perfectly naked, with glossy black hair and graceful limbs.

To the Tamils, as already stated, belong "the Mookwas, or, as they call themselves, Mukuger." If we may really impute to them a separate origin, as Pridham‖ does, who traces their descent from the Nairs and Mookwas of the Malabar coast, all observers nevertheless agree that from their physical appearance they must be very nearly related to the Tamils, if they are not actually Tamils. The fact that the Mukkávar are Christians, and part of them also Muhammadans, whilst many of the Tamils adhere to the teachings of Brahma, has made the first a special object of attention.

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* Tennent, *l. c.*, II., p. 156.
† Wolf, a. a. O. II., s. 156, 167.
‡ Selkirk, *l. c.*, p. 68. Pridham, *l. c.*, I., p, 465.
§ Tennent, *l. c.*, II., p. 514
‖ Pridham, *l. c.*, I., p. 466.

Until of late only a single skull of a Tamil or Malabar was known in Europe. This I found in the collection of Mr. B. Davis. Besides this there was in the same collection the skull of a hybrid of Malabar and Sinhalese (No. 316). Through the kindness of Mr. Freüdenberg, Consul, I have received three Tamil skulls, unfortunately all without the lower jaw, and with these a child's skull, marked Sinhalese, which I have already described, and of which I entertain the suspicion that it belongs to the group of Dravidas. Properly speaking, we have accordingly only four specimens, in a broader sense we may say six. The first four are recognisable as male, the two last have so slight sexual characteristics that their distinction is doubtful.

The following is a detailed description of the skulls which are at present in my possession.

Skull No. 1.

A still youthful, apparently male skull, without lower jaw, in which all the teeth are erupted, but so far as they are present (the incisors, the right cuspids, and three bicuspids are wanting) are very little worn off; the *synchondrosis spheno occipitalis* is closed. Capacity small (1,155 cub. cm.), ratio of length to breadth (72) decidedly dolichocephalic, ratio of length to height (79·4) quite as certainly hypsicephalic.

Looked at from above the skull seems somewhat unsymmetrical, especially the left parietal eminence, which is lower and flatter. On the contrary, the left half of the *squama occipitalis* is higher and fuller, the right flattened laterally, the lambdoidal angle very irregular, the right leg falling down abruptly close to the continuation of the sagittal suture; the left, on the contrary, extending almost horizontally. The latter, moreover, contains in its lower part, near the side fontanelle, long *ossa wormiana.* The shape of the skull is decidedly long, mainly owing to the very narrow prominent occipital portion. In front, up to the *tubera parietalia,*

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* Barnard Davis. Thes. Cran., p. 134.

rather broad, broadest in the region of the latter. Sutures perfect, no trace of *foramina parietalia.* In this region the sagittal suture is rather simple. Strongly marked phænozygy.

At a side view we get the impression of height, and hence also of the shortness. The brow tolerably straight, orbital ridges hardly developed. The upper part of the forehead above the eminences greatly arched, and rising up just in front of the *coronaria.* The descent of the parietal curve toward the occiput is abrupt. High *plana temporalia* intersecting the *tubera squama temp. platt.* Large *alæ*, with very short *anguli parietalis:* at the right 35, at the left 34 cm. broad.

The *norma occipitalis* shows a very high pentangular contour, rather flattened above, horizontal below, with very high and perpendicular sides, only diverging a little below. High and, as mentioned above, very irregular *squama occipitalis*, with somewhat compressed sides, no protuberance; *lineæ semicirculares* well defined, sharp *crista perpendicularis*, slight cerebellar archings, short *facies muscularis.*

In the *norma basilaris* the skull appears broad, especially in the jugular and mastoid region, whilst the occiput is very narrow and prominent. The *foramen magnum* a long oval, somewhat oblique, 34 mm. in length, 26 in breadth, index 76·4. Articulations prominent toward the front. Mastoid processes thick, but not long on either side, with large secondary eminences on the posterior surface, especially prominent on the left side. The styloid processes well developed, the articular surfaces for the lower jaw very deep. *Hamulus pterygoideus* and end of the *lamina externa* very large.

At a front view the head seems high, forehead full, nasal process very broad. Orbits high, with a diagonal widening below and externally; index 84·4, hence mesokonch. *Fissura orbitalis inferior* very wide and hollowed out at the end. Nose narrow above and below; bridge prominent and somewhat rounded; index 48·8, hence mesorrhine. *Fossa canina* a little depressed on the molar bone on both sides; a posterior superior fissure, and a large marginal tuberosity. Alveolar

process strongly prognathous, but only 18 mm. long, with very large *alveoli*. Palate deep and broad behind, with slightly horse-shoe shape. Alveolar ridge 90, therefore brachystaphyline. Horizontal plate of the palate bone more prominent anteriorly in the middle; short *spina nasalis posterior*.

Skull No. 2.

A senile male skull without lower jaw, of small, but yet, beside the others, of relatively larger capacity (1,260 cub. cm.), still dolichocephalic (74·8), and of moderate height (length to height index 73·7); very marked places of attachment for the muscles. Occipital protuberance large, almost hook-shaped. The nasal prominence of the frontal bone broad, protruding greatly, and with jagged traces of the lower part of the frontal suture. The right malar bone, with the contiguous part of the upper *maxilla* and zygomatic arch wanting; right side of the skull slightly eroded by decay.

In the *norma verticalis* the skull seems a pretty regular and broad oval, with its greatest extent in the region of the parietal eminences, and slightly phænozygmatic. The middle part of the sagittal suture rather simple, the left *foramen* wanting, the right lying very near to the suture. The lower side divisions of the coronal and of the *sutara spheno frontalis* obliterated; beginning of *synosteosis* of the *spheno frontalis.*

In the *norma temporalis* we see very high planes, which reach above the *tubera* and up to the lambdoidal suture, ending posteriorly on the left in a thick sclerotic surface whose edge overlies the lambdoidal suture; *ala* broad and indistinct on the right, 26 mm. broad on the left.

In the *norma occipitalis* the section is seemingly nearly pentangular, broad, moderately high, with a somewhat flattened roof. The *squama* are large, especially broad; the lambdoidal angle about 160 degrees. The protuberance well developed, as also the *linea semicircularis superior;* in place of the *linea suprema*, however, a flat ridge. *Facies muscularis* strongly marked; cerebellar archings only slightly developed, middle

portions rather depressed, near the *crista perpendicularis* two *foramina*.

In the *norma basilaris* the breadth of the middle and posterior regions very evident. *Foramen magnum* very large, long, and somewhat oblique, 38 mm. in length, 28 in breadth, index 73·6. Articulating surfaces very prominent; behind them, on either side, a thickened portion of the edge, especially on the left, which corresponds to an articulating surface on the arch of the atlas. Mastoid processes large and long, with a very deep fissure; very large styloid processes; enormously developed *lamina externa pterygoidea*, larger but thinner Hamular process; to the right quite a long *foramen civinini;* deep glenoid cavities.

In the *norma frontalis* head appears moderately high; face, however, rather short. Large frontal sinuses; nasal eminence prominent, with broad jagged remains of the frontal suture. Orbits high and wide, principally hollowed out diagonally below and externally; index 83·3, mesokonch. Malar bone small; nose above quite small, with sharp and only slightly bent bridge; index 51·1, on the borders of mesorrhine. *Sutura naso frontalis* rather strongly inclining upward, and articulating with the very moderately broad nasal process of the frontal bone. *Fossa canina* full; *foramen infraorbitale* small and flat; alveolar process strongly prognathous: side parts obliterated, only the middle and front still remaining and prominent; palate atrophied.

Skull No. 3.

A still youthful male skull, without lower jaw. All the teeth were fully formed, but the incisors, cuspids, and bicuspids have fallen out; first molars very large, and the crowns greatly worn; only the wisdom teeth without traces of wear, and small; dark betel-colouring of all the teeth. *Sutura spheno occipitalis* closed. Muscular attachments strong, although the bones on the whole delicate. Capacity small, 1,200 cub. cm. Form hypsimesocephalic, although bordering upon

dolichocephaly; index of length to breadth 75·3, to height 80·9, strongly prognathous.

Top view: short, especially posteriorly; moderately broad; phænozygmatic; sutures open; sagittal suture in the region of the *foramina* wanting.

Side view: short and high; greatest height behind the line of the ear and two fingers' breadth behind the coronal suture. High, straight forehead, strongly incurvated, with large orbital ridges, deep *glabella*, and well-marked eminences; posterior part long and rising; coronal suture pressed far back. Middle of the head short, and much arched. From the crown a sudden descent, with short arching. High *plana temporalia* reaching to the lambdoidal suture, and here forming a large prominence; *squama temporalis* very flat; on the right stenokrotaphy, with *epiptericum spheno frontalis*. The *angulus parietalis* entirely wanting, the *portio orbitalis ossis frontis* in compensation, slightly arched forward. The *ala* is almost wholly prevented from articulating with the parietal bone: it only touches it at its posterior end, under which the *epiptericum* is pushed. Coronal and spheno temporal sutures run almost in a direct line. *Spheno frontalis* long, in a line with the *squamosa*, which is posteriorly lancet-shaped, 11 mm. long, 5 high; *epiptericum* articulating with the *ala*. *Ala* itself strongly incurvated in the middle, yet broad; on the left the *spheno parietalis* short, the angle little developed, so that the *squamosa* and the *spheno parietalis* and *spheno frontalis* run almost in a line; *ala* flat and broad.

		Right.		Left.
Spheno parietalis	...	1 mm.	...	7 mm.
Spheno frontalis	...	23 mm.	...	20 mm.
Breadth of the *ala*	...	25 mm.	...	25 mm.

Back view: very high, sagittal region quite prominent, only the suture itself somewhat depressed. The form of an assumed section, about pentangular, but the upper and lateral surfaces slightly arched. Eminences prominent, *squama* high, lambdoidal angle acute, *squama superioris* strongly

arched, protuberance small. *Facies muscularis* large, and, on the whole, arched; cerebellar archings, instead, slight.

Lower view: short, rounded behind; *foramen magnum* short, 34 mm. long, 29 broad, index 85·2; very strong articulating surfaces, placed rather far to the front and near together. Mastoid processes large; left divided, but has a slighter fissure. Deep and large glenoid cavities.

Front view: high, arching pretty regularly above; well-developed nasal eminence, with somewhat porotic surface; in the middle of it a finely indented remnant of the frontal suture, at either side of it an arching forward, owing to the frontal sinuses. High, somewhat oblique orbits, with rounded roof; index 86·4, hypsikonch. Anterior part of the spheno-maxillary fissure broad. Nose narrow above, bridge almost sharp, somewhat deeply incurvated and arched; aperture broad and high; index platyrrhine. *Spina nasalis anterior* large. *Fossa canina* moderately depressed. *Foramen infra orbitale* flattened. Cheek bones projecting greatly, with rather short posterior superior fissure. Alveolar process short, 14 mm., still strongly prognathous, because of the large *alveoli*. Palate very broad; index 87·1, brachystaphyline. Alveolar ridge slightly converging posteriorly, yet somewhat in the shape of a horse-shoe. Teeth on the whole very large. The anterior part of the palate surface forms an oblique descent. Slight *spina nasalis posterior;* large (14 mm. long) palatine plate.

The single skulls present certain peculiarities which impair their typical value. This is especially true of the first, which shows a considerable degree of plagiocephaly, with great irregularities in the lambdoidal suture. In all probability the obliquity has operated as a pressure, which has affected one side of the occiput, but it is difficult to say whether this pressure has been an artificial one, and if it came first after birth. The extent of the aberration in the configuration of the lambdoidal suture appears to indicate rather a disturbance during fœtal life. We found something

resembling this in the Siṇhalese skull No. 1, in which the disturbances even extend to the skeleton of the face, and it had better therefore be omitted in the comparison.

The irregular formation of the *processus pterygoides* in the second case, where is found, on the right side, a hyperplasia of the *lamina externa* and a large *foramen civinini*, renders this one also unsatisfactory for an entire comparison. Somewhat more considerable are the temporal deviations in the third case, where at the right is found separating *epiptericum*, and at the left a shortening of the *angulus parietalis;* but we found something similar with the Siṇhalese, for in No. 1 we encountered on either side a frontal continuance of the *squama temporalia*, and in No. 2 a right-sided *epiptericum.* It would indeed be very desirable to have skulls without these individual peculiarities (although possibly somewhat common to the race), but at present they are not to be obtained.

Turning now to the comparison, we find that the average capacity of the skull is very moderate. The skull out of the Davis collection is the largest; its capacity 1,375 cub. cm. Mine have 1,155, 1,160, and 1,200 cub. cm. The average amounts to 1,247 cub. cm., hence somewhat less than the average of the Vẹddás (1,261 cub. cm.), and very much less than that of the Siṇhalese (1,406 cub. cm.). Considering the small number of Tamil skulls, I should not be willing to take this proportion as the standard, but it shows that the low figures of the Vẹddá skulls must not be looked upon as wholly exceptional. The skull of a hybrid in the Davis collection has a somewhat higher measure, viz. (according to Mr. Welcker's tables), 1,325 cub. cm. My doubtful Siṇhalese skull, No. 3, although belonging to a child, is also comparatively roomy, its capacity being 1,250 cub. cm. But these specimens cannot be taken into consideration in computing the average.

The horizontal circumference of the skull out of the Davis collection amounts to 495 mm.; mine measure 477, 490, and 473 mm., giving an average of 483 mm., differing little

from that of the Vẹddás and the Siṇhalese, though somewhat smaller than with the latter. The hybrid, No. 316, of Mr. Davis has only 475, not much more than the Siṇhalese (?) child, 472 mm.

The vertical circumference, on the other hand, constantly rises above that of the Vẹddás as well as the Siṇhalese. It amounts in my three skulls, in the average, to 306 mm., against 289 with the Vẹddás and 295 with the Siṇhalese. This average is only 174 mm. smaller than that of the horizontal circumference of the corresponding skulls (480 mm.), which is 63·7 per cent., against 59·4 with the Vẹddás and 60·5 with the Siṇhalese. This difference is very noteworthy. It is found also with the child (Siṇhalese No. 3).

The circumference of the skull from Mr. Davis's collection, taken through the sagittal suture, measures 353 mm.; that of mine 359, 351, and 352; therefore, in the average, 353 mm., against 376 with the Siṇhalese and 363 with the Vẹddás. Plainly the question here, however, is as to the complementary relation to the vertical measure, for the sagittal circumference in length amounts in the case of the—

Tamils, to	...	...	73·0 per cent.
Siṇhalese, to	...	...	74·3 ,,
Vẹddás, to	...	...	74.5 ,,

of the horizontal circumference.

In an investigation as to the share of the individual portions of the roof of the skull to its whole circumference *(scheitelbogen)*, the striking anomaly is directly presented of the plagiocephalic skull (No. 1 in my collection), which is remarkable for the great development of the middle and back parts of the skull-roof, owing to which there is a perfectly abnormal shortening of the frontal portion. This will be best understood by a comparison of the figures.

	Frontal. mm.	Parietal. mm.	Occipital. mm.
Davis, No. 314	129	122	102
Virchow, No. 1	117	132	110
Do. No. 2	134	120	97
Do. No. 3	130	122	100
Average	127	124	102
Average (omitting No. 1)	131	121	99

Calculated according to the percentage of the whole sagittal arch :—

	Frontal. mm.	Parietal. mm.	Occipital. mm.
Davis, No. 314	36·5	34·5	28·8
Virchow, No. 1	32·5	36·7	30·6
Do. No. 2	38·1	34·1	27·6
Do. No. 3	36·9	34·6	28·4
Average	36·0	34·9	28·8
Average (omitting No. 1)	37·1	34·4	28·2

It is clear from this that for a precise comparison No. 1 must be left out entirely. The two others, however, previously mentioned, viz., that of the hybrid (No. 316) from the Davis collection and that of the child marked Siṇhalese No. 3 from mine, very decidedly approach the Tamil type. They coincide so exactly with one another that the suspicion of the child's skull being really a Tamil skull, or at least a hybrid, grows upon me strongly. The figures for these are the following :—

	Frontal. mm.	Parietal. mm.	Occipital. mm.
Davis, No. 316	122	125	104
Virchow, No. 3	121	125	103
Or per centage :—			
Davis, No. 316	34·7	35·6	29·6
Virchow, No. 3	34·6	35·8	29·5

Contrasted with the Tamils proper the brow here recedes somewhat, whilst the occiput and parietal portions are more developed, and owing to this all the Tamil relations are a little changed.

If, on the other hand, we compare the Tamils with the Vẹddás and the Siṉhalese, a radical contrast appears, especially as regards the share of the brow and the upper part of the occipital bone in the forming of the skull-roof. Whilst with the Tamils it culminates in the frontal division, with the Siṉhalese, and still more with the Vẹddás, the occipital is strongly developed. The hybrid, in the stronger parietal development, comes nearer to the Siṉhalese.

Still more striking are the variations in regard to the form of the head. To be sure, my plagiocephalic Tamil skull, No. 1, here takes an exceptional place, because owing to its surprisingly little breadth (126 mm.) it gives a low dolichocephalic index (72). On the other hand, the skull out of the Davis collection has a high mesocephalic index (79), and of my two Tamils, one (No. 2) is at the extreme boundary of dolichocephaly (74·8), the other (No. 3) even beyond this, and at the beginning of mesocephaly (75·3), the average being 76·3, therefore mesocephalic. The two hybrids show the same relations; skull No. 316 of Davis has an index of 76·7, the child's skull in my collection has one of 77. This, contrasted with the excellent dolichocephaly of the Siṉhalese, and, with a few exceptions, of the Vẹddás also, is a very important result.

The smaller occipital development of the Tamil can be seen from this, that the horizontal length of the occiput in relation to the entire length (*a*) is less; on the other hand, the basilar length in the same relation (*b*) is greater.

	No. 1.		No. 2.		No. 3.
(*a*)	27·4	...	23·4	...	27·0
(*b*)	57·1	...	54·1	...	55·8

The greatest length on an average is small. With Davis it amounts to 173, in my skulls to 175, 179, and 170; hence in no case reaching even the moderate measure of 180 mm. The hybrid from the Davis collection measures only 168 mm., while my child's skull measures 172. The greatest breadth, which is always in the parietal region, is found in a skull of

Mr. Davis's, 137 mm.; in mine it is 126, 134, and 128; in that of the hybrid 130; in the child's skull 132 mm.; hence in none of them anything considerable. In comparison with these the measures of the vertical height are 137·5,—remarkable: in the same order they are 132—139, 132, 137·5,—132,—and 133. The greatest number here, therefore, is that of the plagiocephalic skull, No. 1, which must be left out of consideration. All the remaining figures are very moderate, even small as contrasted with the Siṇhalese, in fact almost on the borders of the Vẹddá figures. The breadth is greater than the height in two out of the three typical Tamils.

The matter takes another aspect if we consider the figures of comparison. The length to height index amounts with Mr. Davis to 76, with my three skulls to 79·4, 73·7, and 80·9, with the hybrid 78, with the child's skull to 77·3. From this the average of the three typical Tamils is 76·8, which corresponds with the hybrids. This is a decidedly hypsicephalic measure, larger than that of the Vẹddás (74·9) or of the Siṇhalese (74·2). This, then, may be included among the diagnostic points.

The auricular index is also correspondingly high. I found it 66·3, 63·1, and 68·8, and with the child 67·4.

Whilst a comparison of the bony skull of the Vẹddá with that of the Siṇhalese proves great similarity, as compared with the Tamil, on the contrary, a great difference is observed. The skull of the latter is hypsimesocephalic, and even when the measure of the contents shows very slight variations, great differences appear in the circumference measures. How much the latter were to be seen in the sagittal circumference and in the share of the different parts of the roof of the skull, has been previously explained in detail.

If we now turn to the shape of the face, we find that with the Tamils it is quite regular.

The orbital index amounts to 84·4, 83·3, and 86·4, hence in the average 84·7, a high mesokonch measure. The child's

skull also gives 83·3. Very similar is the index of the Veddás, while, on the other hand, that of the Siṉhalese seems to be lower. On the whole the orbits are high, in one case (No. 3) even hypsikonch, the upper edge in most somewhat bent, and the diagonal from within and above downward and outward lengthened.

The nasal index of my three skulls shows 48·8, 51·1, and 53·1, —an average of 51, hence on the extreme verge of mesorrhiny. No. 3 only is platyrrhine. The child's skull alone gives the high platyrrhine measure, 55·5. In so far the Tamil nose probably resembles the Veddá nose more than the Siṉhalese. But here also the index gives no distinct idea of the shape of the nose. In its bony parts it is throughout narrow and prominent, although the nasal process of the frontal bone is very broad. The bridge is a little bent in, rather sharp and aquiline. The nose, however, with them all is of little height, which may in the living have rendered it quite different from the Veddá nose.

The face measures are scarcely satisfactory. Only the skull in the Davis collection has a lower jaw, and in this the index is 85·7, a mesoprosopic measure. Of my skulls, the senile (No. 2) must be omitted because of its defective alveolar processes; the other two have middle-face indices of 51·6 and 53·4. The relation of the molar breadth to the middle-face height amounts to 68·8 and 62·3. The Tamil face occupies a middle position between the Siṉhalese and the Veddá face: it is shorter than the first and longer than the second.

As regards the alveolar index, this amounts to 90, 94·8, and 97·8, therefore in the average 94·2. The degree of prognathy, which is quite clear with the Tamils, is with no more certainty to be ascertained from this than from the (nasal) facial angle. The size, especially of the *alveoli* of the incisors, necessitates a strong projection forward of the alveolar process. But the palate also is decidedly broad; hence we have a palatal index of 90 and of 87·7, a brachystaphyline measure. And herein lies a very striking contrast to the Siṉhalese. The size of the

palatine plate of the *os palatinum*, on the other hand, shows a certain similarity to theirs.

The Moors, or Moormen.

According to the information which I have already given Arabian colonies were at a very early period established in Ceylon for commercial purposes. Even at the present day a large part of the smaller traffic is in the hands of these people, who are still engaged in maritime intercourse with the Continent. Sir Emerson Tennent* deduces from this the appellation "*Marakkala-minisu*," or "Mariners." There are, however, "Moorish" villages and settlements also upon the Island. About Batticaloa especially, they seem to have introduced, or at least to have here brought to greater perfection, the culture of the palm, in the same way as in the south of Spain.† But in spite of this their number is small, and their effect upon the rest of the population even less highly to be estimated, because of their religion, which necessitates a sharply-defined separation, so that they rarely intermarry with the Siṇhalese or other natives.‡ I would not, however, omit them, since in a very characteristic way they occupy a distinct place under the caste organisation. As mentioned they are "attached" to the *Kshudrawaṇsa*, and among them to the Fisher caste (*Karawé*).

Unfortunately we have scarcely any descriptions of their physical peculiarities. Wolf,§ who certainly seems to include all sorts of people under the name of "Black Turks," says the Moors are black, but have strong limbs, thick calves, and shorn heads. Thunberg || describes them as large of stature, darker than the rest of the islanders, and well clothed. Pridham¶ declares them to be the handsomest race in the Island, after the European, of martial appearance, and almost without exception tall and well formed. Davy says, "In dress,

* Tennent, I., p. 632.
† *Id.*, II., pp. 456–58.
‡ Pridham, I., p. 479.
§ Wolf, a. a. O., I. S. 169.
|| Thunberg, vol. IV., p. 188, quoted by Philalethes, *l. c.*, p. 244.
¶ Pridham, *l. c.*, I., p. 479.

appearance, and manners they differ but little from the Sinhalese."

So far as I can learn there is only one skull of a "Moor" in Europe, and that is in the possession of Mr. Barnard Davis.* This one (No. 317 of his collection) came from Colombo. It is a male skull of 1,495 cub. cm. capacity, therefore tolerably large, with a length and breadth index of 70, length to height index of 71, and a face index of 85·7; it is accordingly orthodolichocephalic and chamæprosopic.

A farther comparison is scarcely desirable, because from a single skull no judgment can be formed as to whether it is really typical of the race.

Malays.

We have earlier discussed the existence of a scattered Malay element. A few statements as to their physical condition have come to us.

Cordiner† describes them, as in contrast to the other races, lighter, more inclining to copper-colour than any other of the Indian races. Selkirk‡ speaks of them as nearly of a copper colour, rather below the middle size, with "flattened foreheads, broad faces, large flat noses, and sharp, fierce revengeful eyes." Pridham§ describes them similarly, and calls them by no means agreeable specimens of humanity. They are active, of a slight yet muscular form.

In the Davis collection there is a Malay skull from Colombo. It is marked male. Its capacity amounts to 1,435 cub. cm.; the length to breadth index is 79, length to height index 76, face index 108. It is therefore hypsimesocephalic and leptoprosopic.

Mutual Relation of Races.

It is conceivable that the question of the origin and relationship of the different tribes existing close to one

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* Davis. Thesaurus Craniorum, p. 134.
† Cordiner, *l. c.*, p. 143.
‡ Selkirk, *l. c.*, p. 74.
§ Pridham *l. c.*, I., p. 483.

another in Ceylon should very early have interested the visitors to the Island.

In 550 B.C. Cosmas Indicopleustes, who lived under Justinian, states, upon the ground of reports from the Greek traveller Sopater, that the natives of Ceylon belonged to different races: he calls them expressly ἀλλόφυλοι.* Even the Chinese were aware that the north of the Island was inhabited by quite a different race from that of the south; the men in the north (the Tamils) they compare to the Hu (Hoo), a people of Central Asia; in the south (the Siṅhalese) to the Liau (Leaou), a mountain tribe in west China, to whom they ascribed "large ears, long eyes, purple faces, black bodies, moist and strong hands and feet," with a long life of a hundred years and more, adding that the men, as well as the women, wore their hair "long and flowing."†

Evidently these old Chinese reporters found no analogy between the Siṅhalese and the Chinese themselves. Nor have they, so far as I know, left behind any accounts from which to conclude that a Chinese colonisation of the Island had ever taken place. All that is gathered from their reports‡ is confined to information about the mercantile and religious institutions, and to one warlike enterprise of the Chinese; but the reports do not come down further than the fourth century of our era, and the defeat of a king of Ceylon by a Chinese army, which occurred as late as the year 1408. Except the statement that in the year 1266 Chinese soldiers entered the military service of king Parákrama, there is no mention made of any longer stay or actual settlement of the Chinese in Ceylon. Notwithstanding this, the Portuguese writer Ribeyro§ has expressed his opinion that the original population of the Island may have been Chinese. Knox‖ also

* Tennent, *l. c.*, I., p. 568.

† Cited by Sir E. Tennent (I., p. 611) from Chinese works.

‡ Tennent, *l. c.*, I., p. 607, *et seq.*

§ *Id.*, *l. c.*, I., p. 327, note 2.

‖ Knox, *l. c.*, p. 61.

heard this story from some Portuguese, but says very decidedly: "But to me nothing is more improbable than this story. Because this people and the Chineses have no agreement nor similitude in their features, nor language, nor diet," and adds: "It is more probable they came from the Malabars, their countrey lying next, tho they do resemble them little or nothing. I know no nation in the world do so exactly resemble the Chingulays as the people of Europe." Here we must remember that he looks upon the Veḍdás and Sinhalese as belonging together: "Of these natives there be two sorts, wild and tame."

This certainly ingenuous statement is of great value. The reference to the Malabars is, as we see, purely speculative. In reality Knox denies any resemblance of the Sinhalese to the Malabars, and finds them much more like the Europeans. This is the first unequivocal testimony to the Aryan origin of the Sinhalese, which since then has been assumed by so many visitors. Davy* says: "The pure Singalese of the interior are completely Indians in person, language, manners, customs, religion, and government." He leaves it indefinite which division of Indians he has in mind, and his mentioning the religion seems to exclude the Aryan or Brahminic division. Certainly he did not refer to the inhabitants of the peninsula of northern India—the so-called Indo-Chinese.

Philalethes† and Pridham‡ alone among the more recent reporters express their conviction of the Chinese origin of the Sinhalese; both, however, not from anthropological reasons, but on historical grounds, and the latter with reference to the system of drainage and terrace building of the Sinhalese, which he traces back to China. The historical grounds are of little importance. With regard to drainage, though the invention of this system may unquestionably be ascribed to

* Davy, *l. c.*, p. 109. † Philalethes, *l. c.*, p. 15, note †.
‡ Pridham, *l. c.*, I., p. 21.

the Chinese, Sir E. Tennent has proved that "the tank system" in Ceylon is of Tamil origin, and was introduced from Hindústán in the fourth century of our era.

After the previous statements no elaborate proof is needed that neither Siṇhalese nor Vęddás, at least in the form of their skulls, present the slightest indication of any relationship to the Mongols. Such a remarkably dolichocephalous tribe has never yet been found among the Mongols. What truth there is in the old Chinese story of the similarity of the Siṇhalese to the Liau in west China I cannot judge ; but it is not even proved that this people is to be regarded as belonging to the Mongols proper. We might rather connect them with the present Laos (on the boundary between China and Siam), whom Gützlaff,* according to their complexion, distinguishes as black and white. According to the opinion of Mr. Schott,† however, the Liau are rather identical with the Ljaos, of whom he states only that they were "south-western aliens," therefore, at any rate, not Chinese. Until we have more precise information about this south-western people, which happily is now in prospect, we cannot draw

* Prichard, *l. c.* Third edition, London, 1884, vol. IV., p. 503.

† Professor Schott communicates to me the following : "The word *Ljao*, of which I thought at first, is the name of a river in the present Mandshooria, after which a Tartar dynasty was named, who for some time ruled over north China. Another *Ljao* (in different dialects *lao*, *lio*, *liu*, formerly even *lot*), which indeed is the one for us to consider, is written very like the former. This signifies, with an added *ja* ('back tooth'), 'prominent teeth,' and is besides, in itself alone, the name for certain south-western outlandish tribes, as I see from the original dictionary, named after the Emperor Kang-hi. The tribe southward from Yun-nan, called by the Europeans *Laos*, is, as far as I know, by the Chinese never called anything but *Lao-tschua*, from *lao*, 'old man,' and *tschua*, 'to beat the drum.' This drum-beating old man is evidently a mere counterfeit of a non-Chinese word, as, for instance, *lang-ja*, 'wolf-teeth,' is the Chinese rendering of *Langka*, that is the Indian name of the Island of Ceylon. Corresponding to the old name for a people or peoples, *Hu*, which designated, in general, the population of central Asia to the north of China, and among these the *Hjün-nu*, or *Hjung-nu*, who have often been confused with the *Huns*, and are certainly in name identical with them, is a word signifying, in its appellative sense, the dew-lap of an ox. Another *Hu*, differently written and distincty national, I cannot trace."

from this citation any important conclusions regarding the physical constitution of the Siṇhalese. I will not, however, pass over in silence the fact that according to an old tradition already mentioned by Valentyn, the Sihala dynasty, from which Wijayo the conqueror was descended, had their residence in Tenasserim ; so that according to this a Siamese origin is ascribed to the Siṇhalese. Since, however, all the more recent investigations agree in this, that the dynasty, as well as the language of the Siṇhalese, is derived from Magadha, the present Behar, that is, from the very midst of the Ganges land, there is no need of our following up the tradition. Besides, it is not the search for the Siṇhalese origin which claims our first interest, but fathoming the derivation of the Veḍdás.

Even in case we consider the Veḍdás to be, as some say, savage Siṇhalese, or the Siṇhalese to be tame Veḍdás, as others say,—thus deducing both from one and the same original stock,—we cannot but begin our investigations with the Veḍdás. A reverse order would be justified only if we assumed that the Veḍdás had sunk back from a condition of higher civilisation to the most absolute savagery, in which condition all travellers have found them for many centuries. The theoretical objection to such an assumption I have pointed out already, and will not bring it up again. But I ask, what signs of an earlier civilisation have actually been found ? Have the remains of a higher culture been discovered anywhere upon the Island, which, with any show of probability, might be attributed to the Veḍdás ? To my knowledge there is nothing of the kind, not even rubbish-heaps (*kjökkenmöddinger*) such as are found in an excellent state of preservation in the neighbouring Andaman Islands. Not one stone implement, such as even the Australian possesses in manifold forms, has been found. Now it is just conceivable that these gaps may be filled by further researches, especially since the above-mentioned remark of Mr. Hartshorne awakens at least a hope of stone axes. But what will be gained

even by this? At best the possibility of placing the Vęddás on a level with the Andamanese and the Australians, whilst, according to the present facts, they must be placed decidedly lower. A people who do not even possess clay vessels, who have no knowledge of domestic animals beyond the dog, who are unacquainted with the simplest forms of gardening and agriculture, who lack almost every kind of social institution, who are not even counted among the outcasts by their civilised neighbours, cannot possibly ever have had the means which make a higher culture of any kind possible. *The hypothesis of a return to barbarism must hence be definitely given up.*

The ground for such an assumption could only be found in the language. How great the difference of opinion with regard to the place which should be given the Vęddá language I have already shown. That it is no Dravidian idiom fundamentally seems to me proved beyond a doubt from the testimony before us. A great number of high authorities, among them some of the first linguists, declare it to be rather a Siṇhalese than an Aryan dialect. But whether the Siṇhalese itself corresponds to one of the other Indo-Aryan languages is again contested. But even if, with the well-informed Childers, we take it for ancient Páli, or rather a primitive sister dialect of the Páli, it will then truly be very difficult for any one to argue from it, and still less from the Sanscrit words intermingled with it, the derivation of the Vęddás from the valley of the Ganges.

For centuries they have been surrounded by more highly cultivated people, and even if they, from shyness, have remained hidden in their forests, a certain intercourse with their neighbours has yet been unavoidable. Where the Tamils have continuously pressed on nearer to them, as in the vicinity of Batticaloa, a part of the Vęddás have adopted the Tamil language.* But during a very much longer period, and

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* Cordiner, *l. c.*, I., p. 91. Bailey, *l. c.*, p. 305, note.

in the greater number of places, they were in immediate contact with the Siṉhalese, to whose kings they stood in a kind of subjection, and from whose line their own chiefs were appointed. What wonder, therefore, if they adopted more and more Siṉhalese words and forms? The question is only whether, beside these, as I suppose, borrowed words, their language has not preserved some individual elements? To this point the collectors of vocabularies and comparative linguists seem to have given very little attention. And yet the words of doubtful origin, as Mr. Hartshorne has designated them, should be most carefully collected and tested. Thus far we are not even informed positively whether the Veḍdá language contains any words designating numbers. What use is it for our investigation that Mr. Max Müller declares more than half the Veḍdá words (that is, of those noted down by travellers) to be corrupt Sanscrit? Where belongs the other half, even if smaller, which perhaps with greater attention might be enlarged? If we cannot class it among the Tamil languages it is very possible that it may prove specific. Nothing hitherto justifies us, it seems to me, in any such one-sided statement as that of Mr. Edward Tylor, who calls the Veḍdá language, without hesitation, Aryan.

The matter would take a rather different aspect if we might assume that originally the Veḍdás alone inhabited the whole Island, and that they were not only forced back into the forests by the immigrants, but had intermingled with them. Of the Tamils, who did not immigrate until later, we may say that in the north they have, in fact, supplanted the original population, but that in the east they have not merely mingled with the Veḍdás, but have accomplished a veritable Tamilisation of the Veḍdás. This appears, however, unimportant for the essential point. Not so with the Siṉhalese. If we follow the statements of the native analyists, the origin of the Siṉhalese is to be traced back to the followers of king Wijayo, a victorious host of immigrants from the valley of the Ganges. It will not be necessary to

take the number of seven hundred people from Magadha (Behar), as the annals give it, quite literally, but whatever it was, the proportion must have been something like that of the Danes and the Normans in England. The larger part of the Island was divided into fields and gardens, and a patriarchal system introduced which has lasted for thousands of years. A series of facts testify that the aboriginal population was not wholly excluded from this system; even the circumstance that the Veddás were reckoned among the high caste of agriculturists (*Goyiwaṇsé*, or *Vellála*) clearly indicates that an established position was early insured to them in the political organisation of the country. Upon such a foundation the intermingling of the Magadha people with the aborigines would most naturally take place, and if we look upon the Siṇhalese race as the result of this commingling, the experience of so many other countries where a similar intermingling took place would make it perfectly explicable that the Magadha people made their language, the old Páli or Eḷu, the ruling one, while in their physical conformation the aboriginal element won lasting influence.

With such a view of the matter the Veddás and Siṇhalese would neither be identical nor distinguished from one another simply by a degree of culture. The Veddás would appear rather as representatives of the aboriginal race; the Siṇhalese, on the other hand, as hybrids, produced by a union of immigrant Indians with Veddás, and therefore varying according to the measure of the participation of either of these elements. This indeed strikes me as being the solution of the anthropological problem before us, so far, at least, as the material at present reaches. The linguistic difficulty, that also the unmixed natives adopted the Aryan language of the conqueror without, as far as we can judge, having been forced to do so, appears to me no longer insurmountable, since from personal experience I have established the fact that in the Baltic provinces of Russia one part of the Finnish population after the other, through

imperceptible but steady progress, has become Letticised to such an extent that the Courland language has wholly, the Livonian almost wholly, disappeared, and only the Esthonian still offers any resistance.*

Considered simply on anthropological grounds, the differences between the Veddás and the Sinhalese are not so great as to oblige us to assume an absolute contrast in the two tribes. I will not deny that the number of skulls we know to be authentic, which I could personally test by comparison, is too small to lead to a definite conclusion; but they seem sufficient to enable us to ascertain whether any reason exists for distinguishing results obtained in other ways. Such reason I do not find. After having with the greatest caution excluded the skulls which were of doubtful origin, as well as those which through peculiar malformation showed great aberrations, there still remains, with the addition of skulls found in foreign collections, so great a number of useful specimens that they much exceed what stands at our disposal relating to other tribes.

Comparing briefly what has been arrived at, the result is first, that the Veddás, as well as the Sinhalese, are dark tribes, whose complexions vary between yellow-brown and black. The greater number of observers describe the Sinhalese as not actually very dark, but rather of a chestnut-brown, or brown with a yellow undertone. Percival describes the women as of a yellow colour; Cordiner and Selkirk assert that the insides of the hands and feet are white. The accounts do not attribute to the Veddás such fair skins; the report of Percival that the Veddás are copper-coloured and fairer than the rest of the Sinhalese is wholly unsupported.

But even allowing that a considerable amount of difference in colour exists between the two tribes, it may at least be taken into consideration that the Veddás are naked, exposed

* Zeitschrift für Ethnologie. Verhandlungen der Berliner Anthropologischen Gesellschaft, 1878.

to all the inclemencies of the weather, without regular habitations, and, moreover, dirty in the extreme—conditions which, even in our climate and under much less trying circumstances, would be enough to bronze the skin very deeply. The Siṇhalese, on the other hand, are more or less completely clothed, wearing something at least on the lower part of the body, live in regular houses under relatively favourable conditions, and are often distinguished for great cleanliness. If then, as reported by travellers, very dark, almost black individuals are by no means uncommon among them, it is certainly a noteworthy fact.

The character of the hair also is plainly similar, only that here the effect of culture is conspicuous to a much higher degree. Whilst the Vẹddás never comb theirs,—perhaps, in general, do not interfere with it in any way,—so that from year to year it becomes more and more dishevelled, and in a bushy matted mass covers head, face, and shoulders, the Siṇhalese exercise a quite unusual womanly care in smoothing and arranging their hair. Both tribes, however, wear the hair long; it is black, luxuriant, and a little wavy; only with the Vẹddás, owing to neglect, it hangs down in a tangled but not curly manner; the tresses, properly speaking, notwithstanding, are neither curly nor woolly. We will add that in single cases a more curly kind of hair is seen, as in that of the elder man among the drawings given,* though even in his case the hair is long and wholly different from the little close rolls and woolly hair of the real Negroes and Negritos. Had it early been cleaned and combed it would probably be like that of the Siṇhalese, glossy as ebony. The picture of the young girl in the drawing* seems to exhibit just this improvement.

A very remarkable statement, looking at the matter as it were from the other side, is to be found in d'Albertis.† This traveller had engaged in Point de Galle, two Siṇhalese for

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* No drawings are reproduced.—*Hon. Sec.*

† L. M. d'Albertis. New Guinea. London, 1880, vol. I., p. 259.

his researches upon New Guinea. When these Sinhalese had become acquainted with the natives of Yule Island (in the Gulf of Papua, at the south of New Guinea) they told him these people resembled their own country people, only that their complexions were not so dark. When he called their attention to the fact that the hair of these natives was "fuzzy" they replied that the Sinhalese also would have "fuzzy" hair if it were not daily combed and carefully oiled. M. d'Albertis mentions in connection, that the hair of one of the Sinhalese, who wore it short, was crisp, and that of the other, who wore it long, was smooth; he also does not deny that many of the natives resembled the type of his Sinhalese. Even setting aside this analogy, as drawn from only two persons, still this statement, so wholly impartial, pretty conclusively proves that the Sinhalese hair, when uncared for, strongly resembles that of the Veddás. A marked contrast is, at any rate, implied to the smoothness of hair of the Malays and Mongols; and the ἁπλότριχα of Palladius must not be understood in the sense that the hair of the Veddás is called smooth without any reservation.

Reports with regard to the colour of the iris are less complete, but we gather from the descriptions that, as a rule, it is dark. As to the Sinhalese, Davy makes more explicit statements, and from these we learn that the eyes are generally black, seldom hazel, rarer still grey, but only among the Albinos light blue or red. To be sure, in the poetic description of an ideal Kandy beauty given, "eyes, the blue sapphire and the petals of the blue manilla flower" are considered desirable, but this can hardly be said to refer to a typical peculiarity. Nowhere is anything of the kind mentioned of the Veddás, and we may therefore assume their iris to be really black or dark brown.

As regards size, plainly both races are of moderate stature, rather short than tall. If the height of the Veddás on the average is 1,537 for the men, and for the women 1,448 mm., with the Sinhalese, on the other hand about 1,625

to 1,650 (men), the significance of the shorter measure of the Vęddás cannot be doubted, and much less since we find the minimum measures for the men amounting to only 1,245 mm.

The information about the Siṇhalese is unfortunately very incomplete ; in one thing, however, all observers agree, that they are smaller and less vigorous than the Europeans. Whether there is only a relative difference in size between Siṇhalese and Vęddás, whether the latter were stunted in growth in consequence of their wretched life, or whether their shortness is a typical race peculiarity, is still doubtful ; yet the fact that they are not all dwarfs, but that comparatively large Vęddás are met with (for the very scrupulous Mr. Hartshorne gives the measure of one man as 1,638 mm.), may be adduced in favour of the hypothesis that their often dwarfish size is a result of long-continued unfavourable conditions for development. Nevertheless, the fact in the main is well established that the Vęddás belong to a small, indeed to one of the smallest known races. If we add that the *Vędiraṭa* is extremely rich in game, that the Vęddás are skilful hunters and fishers, that honey and edible fruits and roots stand in plenty at their command, we cannot say that, like the Australians, they suffer from enforced deprivations. If, notwithstanding, they are much smaller than the Australians, it seems to me we must recognise their smallness of stature as constitutional.

Concerning their development of muscle and strength of body, the witnesses testify loudly in favour of the Vęddás. Though the fleshy parts are rather slender, perhaps even lean, the Vęddás seem to possess, in general, great capacity for active effort, and limbs of good proportions. Compared with the Siṇhalese in the lowlands they may be said to show a certain superiority in all work requiring muscle, for it is the Siṇhalese of the mountains only, especially the Kandyans, who are renowned for physical strength. The shortness of the thumbs and pointed elbows, emphasised

by Mr. Hartshorne, may be explained among the Veḍdás, perhaps, by their shortness and leanness;—at any rate, only the first would be of any importance if it should be proved by measurement to be altogether disproportionate. Perhaps we meet here, however, with a deception similar to that of Mr. Bennett's, who lays such stress upon the length of the foot, whilst direct measurement shows perfectly fair proportions. It may be true that the Veḍdás are flat-footed, but this would not be sufficient to constitute a race-distinction.

Similar observations, only still less distinctive, we find in regard to the size of the head, especially the capacity of the skull. The single numbers, as well as the averages, I have already given, and compared with one another. The result proves that the Veḍdá skulls on the average are much smaller than the Siṇhalese; in fact, that a certain number of them can be called positively nannocephalic. The Siṇhalese skulls, however, have only a capacity on the average of 1,406 cub. cm., and among eleven examples only three between 1,100 and 1,200 cub. cm. If we weigh against this that also among the Veḍdá skulls were two of 1,614 and 1,420 cub. cm., it follows that (supposing these skulls to be genuine) not only is nannocephaly no constant characteristic, but skulls of even great capacity are found among the Veḍdás. The numbers slide over from both sides; the highest average of the Siṇhalese does not prevent the occurrence of very small examples; and *vice versâ*, the certainly very low average of the Veḍdás includes some pretty large specimens.

I will not rehearse the length measurements and the relations deduced from them. In this way certain differences between the two tribes have come to light, but we shall be able to represent them parallel to each other in the indices. To only one of the proportions will I here call attention, because this may be of considerable importance, viz., that with the Siṇhalese the front and middle head have a larger share in forming the roof of the skull, while with the Veḍdás it is the occipital region. Yet I am bound to mention

that the frontal breadth (lower) of the Vęddá skulls from the Colombo Museum was by no means less than that of my Siŋhalese.

Of special interest is the comparison of the skull indices. The average ratio between length and breadth which I have ascertained is for both tribes almost identical: 71·8 for the Siŋhalese, 71·6 for the Vęddás. This is a highly dolichocephalic measure. If by this is proved that all the Siŋhalese skulls we have for examination are dolichocephalic, and that among twenty-eight Vęddá skulls four were mesocephalic, we might suspect Tamil skulls had been intermingled with the latter. This cannot be decided without new and very sure material. For our present comparison we can only assume that these important relative measures do not point to any radical difference in race between Siŋhalese and Vęddás. With both the skull is long and narrow, yet among the Vęddá skulls there is a greater number in which the narrowness is extreme than among the Siŋhalese.

It is the same with the ratio between length and height. This is orthocephalic with both tribes—with the Vęddás indeed even to the border of hypsicephaly (74·9), with the Siŋhalese somewhat less (74·6). But we must, in both kinds of skulls, calculate from those of medium height. With reference to the height measurements the ratio is somewhat different, in so far as here the larger figures are on the side of the Siŋhalese.

These coincidences of the main indices are so great that they could not be greater within the limits of a single race. The configuration of the capsule of the skull may, aside from the share of the separate bones in it, be considered as identical. In fact, according to the testimony of travellers, the difference of race is more conspicuous in the face than in the skull. It is chiefly in the form of the nose, particularly the flatness of its ridges and the breadth of the nostrils, but likewise to the form of the lips and jaws, which are throughout described as prognathous, the various authors call

attention, as being characteristic features of the Veḍdá face. Contrasted with the Siŋhalese nose, which the old Chinese reporters call a bird's beak, and in the description of the Kandy beauty is compared to a hawk's bill, contrasted with the delicate lips and orthognathous jaw, which we perceive in Davy's drawings, we find certainly very striking differences.

Osteological investigation has, regarding the main facts, confirmed these observations made among the living. Unfortunately we have not been able to turn the skulls found in Europe to much account in this direction, owing to the difference in the published measurements, and least of all indeed with the Siŋhalese; moreover, it is very unlucky that the two skulls in my possession, of which one has belonged to a young, the other to a very old man, show great individual differences.

In general the skeleton face of the Siŋhalese is narrower and longer than that of the Veḍdás. The former prove to be leptoprosopic (index 89), the latter chamæprosopic (index 83–84). Corresponding to this the palate with the Siŋhalese is more long and narrow, with the Veḍdás rather short and broad, with a prognathous jaw. In this last particular the contrast to the Siŋhalese is not so clear, since Mr. B. Davis has made no reports concerning it, and of my skulls, one is a strikingly prognathous one, although not having a long alveolar process. Moreover, with the Veḍdás occurs mesokonchy (84·6) and mesorrhiny (52), with many individual aberrations, it is true; so that with the women we have more platyrrhine, with the men more leptorrhine forms. On this point the Siŋhalese material is very unsatisfactory and quite inadequate. I will return to this latter, although pretty much all concerning it is conjecture. I add here only the comprehensive judgment of Mr. B. Davis* in respect to the type of the Ceylonese and Indian population.

* Davis. Thesaurus Craniorum, p. 158.

"In Ceylon and the plains of India we have found the people (Veddahs as well as the more elevated races), as far as our material extends, characterised by small, narrow, long, and rather tall crania, having prominent nasal bones and well-expressed faces when we refer to the typical skulls. As soon as we ascend the southern slope of the Himalayas we meet with races of a very distinct cranial type." Whether this judgment refers to the non-Aryan tribes of India is far from clear; certainly in this generalisation it may remain an open question.

If we now draw into comparison the Tamils or Malabars, we come in contact with a much more widely diffused prejudice, although it has only found expression in recent times. Ribeyro had early the opinion that the Siṇhalese originated in a mingling of Chinese and Malabars (Gallas*). Knox† also, although he found little or no similarity between Malabars and Siṇhalese, on historical grounds considered a relationship possible. The later writers have (chiefly from outward observation) looked upon the Siṇhalese as Aryans, and sought to find a Dravidian origin for the Veḍdás. Lassen‡ only, who considers the Veḍdás as that portion which had remained unchanged, traces back, on linguistic grounds, the entire "people of the Cingalese" to Dekkan tribes. Sir E. Tennent§ also alludes to the existence of linguistic and religious (if we may use such an expression) affinities which seem to point to the people of the Dekkan; he assumes‖ that the Veḍdás have the same relation to the Aryan Siṇhalese as the mountain tribes of India to the later Aryan immigrants. He mentions especially the Koolies in Guzerat, the Bheels in Malwa, the Puttooas in Cuttack, the Khoonds in Gundwana, the Bedas in Mysore, and the wild

* Pridham, *l. c.*, I., p. 21.
† Knox, *l. c.*, p. 61.
‡ Lassen. Indische Alterthumskunde, I., s. 199.
§ Tennent, *l. c.*, I., p. 328.
‖ *Id.*, *l. c.*, II., p. 438.

hordes in the mountains to the east of Bengal. Mr. Bailey* concurs with this view. He not only brings forward the Khonds, the Puttuwas or Juanguas, the Pulindas (in Orisa), the Meekirs (in north Cachar), &c., but extends his comparisons even to Assam, Tenasserim, and east Burmah. But his proofs also are drawn wholly from the social and religious life of these peoples. Without any special evidence is the statement of Mr. Tagore† that a wandering tribe known to the Ptolemies in the northern part of India, the Vaidehas, and who were later encountered by Tippoo Sahib in Mysore under the name of the Bedas, are still extant in their wild and savage condition in the Veddás of Ceylon. Mr. Jagor‡ mentions that the Bedas who live in little groups in the woods of Travancore and Cochin are considered by some to be a branch of the Veddás of Ceylon. However interesting these suggestions may be, they still appear to me to assist very little toward the settlement of the disputed question.

Anthropological comparisons have until now hardly been undertaken. Neither have I the intention so far to extend the present investigation, although a variety of material for it is before me. I shall certainly make some references to such, but a full discussion of all the points to be considered would require a much more extensive work. In the first place it will be necessary to take the Tamils of Ceylon into comparison, and chiefly because the historical accounts, going backward as far as Wijayo, inform us of numerous marriages, not merely of the kings, but of their retainers, with the Malabar women, not to mention the very early invasions and settlements made in the Island by Tamil hordes.

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* Bailey, *l. c.*, p. 307.

† Transactions of the Ethnological Society of London. New series, 1863, vol. II., p. 381.

‡ Zeitschrift für Ethnologie, 1879, Bd. XI. Verhandlungen de Berliner Anthropologischen Gesellschaft, s. 167.

In spite of the meagre reports with regard to the physical charateristics of the Tamils we cannot doubt that they, likewise, are very dark, more or less black, and have long black hair. For the rest, observers lay much stress on their great strength and activity, nothing more. Hence there remains to me only the scant craniological material found in the collection of Mr. B. Davis and in my own. This is all insufficient for a final authoritative answer to the question of the ethnological relation of the Tamils to the two other Ceylonese tribes, and hence my conclusion is only to be accepted with great reservation.

All these skulls are comparatively small, and certainly no one would infer from them that they belonged to a powerful race. As already stated, the average capacity of a Tamil skull is 1,247 cub. cm., which is even less than the average of the Vẹddás and of the Siṉhalese. It is scarcely possible to look upon this number as the typical one for the race, in my opinion, and it is only interesting as showing that smạll skulls may be found among all the tribes of the Island. Still there is none among them which reaches the minimum number of the Vẹddás.

More important, however, is the difference in the form of the head. The Tamil skull, to judge from these specimens, is hypsimesocephalic, in fact wholly different from the Siṉhalese and the Vẹddá skull. Its index of breadth is 76·3, of height 76·8. Corresponding to this its transverse vertical length is greater than its sagittal circumference length. With reference also to the share of the single bones in the formation of the roof of the skull we find a considerable difference; the *squama occipitalis* is much smaller; the frontal bone, however, considerably larger than with the Siṉhalese, and still more emphatically with the Vẹddás. The basilar view shows plainly the extraordinary shortness of the occipital region.

I must say after this, that the skull of the Tamils, so far as recognisable from those we have under consideration, exhibits

no relationship either with the Veḍdás or with the Siṉhalese. The proportions of the face may briefly be stated in the following formula: mesokonchy, mesorrhiny, mesoprosopy, prognathy, and brachystaphyly.

This positively distinguishes the Tamil face from the Siṉhalese, and brings it nearer to the Veḍdá face. But as I have already said, the almost complete identity of the nasal indices (Tamils 51, Veḍdás 50–52) does not prevent the greatest variety in the formation of the nasal bridge. Owing to the greater narrowness of the nasal bone, as well as to the prominent, slightly bent in, and comparatively sharp nature of the bridge, we perceive a certain resemblance to the Siṉhalese nose. Therefore, should we least of all be justified in representing the flat, and, toward the lower part, broad nose of the Veḍdás as a Tamil inheritance? A comparison of the profiles of the faces at a lateral view in Fig. 3, upon my three skull Tables, will show conspicuously the difference in the formation of the noses.

I might in like manner refer to Fig. 1 about the formation of the orbits, and to Fig. 5 in regard to the formation of the palate. Considering the difficulty, however, of showing these relations with perfect distinctness in a drawing, it seems to me that it will tend materially to facilitate a clear understanding of them if I show the principal lines by themselves, and of their natural size. I aim at the same time to draw attention more particularly to some hitherto rather neglected points, and to put sharply defined questions for later discussion. For, to my great regret, I am not in a position to assume any responsibility as to the ethnological significance of my lines. I can only say that I have chosen from the three series those skulls which, after mature consideration and testing, seem to offer the best guarantee that they, to some extent, positively exhibit the race type.

The wood-cuts,* for which the three skulls represented

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* Not reproduced—*Hon. Sec.*

in my tables have been used, show the exterior outlines of the noses and orbits. The horizontal line, after which these skulls as well as those on my Tables have been arranged, is the so-called German horizontal line, which is drawn from the lowest point of the inferior edge of the orbit to the highest point of the superior circumference of the outer ear opening. The difference in the form of the entrance to the orbit is in this way quite as perceptible as the difference in the distance of the orbits from each other, and in the position of the edges of the orbital entrance toward the horizontal line.

The measures and indices of the orbits in question are as follows :—

	Breadth.	Height.	Index.
Veḍḍá ...	39 mm. ...	33 mm. ...	84·6
Siṇhalese ...	39 mm. ...	30 mm. ...	76·9
Tamil ...	37 mm. ...	32 mm. ...	86·4

According to this the Veḍḍá orbit is mesokonch, the Siṇhalese chamækonch, the Tamil hypsikonch. The difference between the first two rests solely on the lesser height, whilst both differ from the Tamils in their greater breadth.

But with this difference is associated a real divergence in the curvature and sloping off of the edges. The curve is slightest with the Siṇhalese, where the upper and under edges are almost straight, and run parallel to each other, so that as the outer edge also is very slightly convex, a flattened quadrangular face with rounded corners is the result. In the case of the Veḍḍá, where the orbits themselves are largest, the edges have a tolerably regular curve, so that the shape of the orbital entrance is almost round, only the diagonal from the top and inside to the bottom outside is longer because of the greater expansion about the cheek bones. Finally, with the Tamil, which exceeds the rest in height, the upper edge is but slightly convex, and the widening toward the zygomatic bone more distinct; owing to this the shape of the orbital entrance becomes an oblique oval.

To this dissimilarity is to be added the very different

formation of the naso-frontal region, as may be seen from the following figures :—

	Vẹddá. mm.	Siṇhalese. mm.	Tamil. mm.
Distance of exterior orbital edges (diam. biorbitaire) ...	95	93	90
Distance of the inner orbital edges (diam. interorbitaire)...	28	19	17
Inferior breadth of *processus nasalis ossis frontis* ...	23	25	21
Direct length of *sutura naso frontalis*	9	13	12

With the Tamil the two orbits stand nearest to each other; the root of the nose is narrow but very prominent; the *sutura naso frontalis* lies deep, taking a straight horizontal course, and the nasal process of the frontal bone, though very protuberant and bearing traces of an extremely jagged frontal suture, is stunted in its transverse development. With the Vẹddá it is exactly the reverse, and the distance of the orbits from one another greatest; the nasal process of the frontal bone, in which also a remnant of the *sutura frontalis* persists, is broad and full; the *sutura naso frontalis*, although short, pushes right up into the frontal bone, and is therefore very high, so that the *sutura maxillo frontalis* takes an oblique course on either side; the root of the nose itself is small and depressed. With the Siṇhalese the proportions are again different, but resembling nearer those of the Vẹddá; the nasal process of the frontal bone is even more broad and full, the nasal frontal suture more symmetrically curved and bulging out at the top, therefore reaching higher than with the Tamil; the distance of the orbits most considerable, the root of the nose itself broader than with the Vẹddá, but the bridge at its starting point more incurvated than with the Tamil.

The form of the aperture of the nose is with the Tamil more like that of the Siṇhalese than that of the Vẹddá. The former has a breadth of 25 mm., the latter of 24 mm., that of the Siṇhalese 26 mm. Hence the nose of the Tamil and of the Siṇhalese is platyrrhine, that of the Vẹddá mesorrhine; the

indices are 53·1, 57·7, 50. In spite of this the Vẹddá nose at its *epiphysis* is flatter and more depressed, the Siṇhalese and Tamil protuberant, the Tamil in fact more than the Siṇhalese. The impression of greater breadth in the root of the nose with the Siṇhalese is only an illusion, and caused by the retreating of the nasal bone into the plane of the frontal processes of the upper jaw, and hence the whole space between the corners of the eyes is flatter and more even. In reality, not only the root of the nose but the entire bony structure of the nose of the Vẹddá is narrower than in that of the other skulls. With regard to this I may once more remark that the nasal indices taken in this way from the relation of the breadth of the aperture to the height of the whole nose, gives no idea of the protuberant parts of the nose. As to the aperture itself, in the case of the Vẹddá it corresponds somewhat to the European type—is pear-shaped: with the other two, especially the Siṇhalese, rather triangular.

An exhibition of the Vẹddá, Siṇhalese, and Tamil palates may render a further comparison of the linear boundaries possible.*

I begin here also with the figures :—

	Length. mm.	Breadth. mm.	Index.
Vẹddá	48	36	75·0
Siṇhalese	53	40	75·4
Tamil	49	43	87·7

Consequently the palates of the Vẹddá and of the Siṇhalese are leptostaphyline, those of the Tamil brachystaphyline. The last varies most in form; its great breadth and shortness stand in correct relation to the form of the skull. Next to this, not in the index, but in the shape of the tooth-curve, comes the Vẹddá palate, the chief distinctive feature of which is that the tooth-curve towards the back draws partly together, and has very nearly the outline of a horse-shoe. Wholly different from the Tamil, and also somewhat differing

* Drawings not reproduced—*Hon. Sec.*

from the Veḍdá, is the Siṇhalese; with the latter the palatal plate is unusually long, and at the same time of considerable breadth, so that it is very large, but the tooth-curve does not form, as with the other two, a more symmetrical curve, but the side parts stretch out in a pretty straight line parallel to one another, whilst the region of the incisors forms a broader, flatter curve, jutting out in front. The relatively large share which the *os palatinum* has in the formation of the palatal plate with the Siṇhalese has been already pointed out. It may be further mentioned that the teeth in the Siṇhalese are most largely developed, and that especially the first molars have unusually large crowns. In the Tamils the *alveoli* of the cutting and canine teeth are very large, so also the first molar, which by far exceeds the rest in size.

The facts given in respect to three of the most important regions of the skeleton face may suffice to show what great difficulties are encountered in attempting to fathom the degree of affinity existing between these three tribes. If we take, as usual, the indices as guides, we gain for each region another combination. Most closely related are :—

(1) according to the orbital index, the Veḍdá and the Tamil;

(2) according to the nasal index, the Tamil and the Siṇhalese;

(3) according to the palatal index, the Siṇhalese and the Veḍdá.

We must not forget, however, that here only one individual is taken from each tribe, and that the examinations I have cited prove that the individual selected by no means corresponded in every single particular to the average of his tribe. Thus the Tamil is platyrrhine, whilst the Tamil average was found to be mesorrhine. If this average corresponds to the typical tribal conditions, then the Tamil nose stands at least as near to the Veḍdá nose as to the Siṇhalese. And yet, as I have shown at some length, it is distinguished in all other respects as well from the Veḍdá as from the Siṇhalese nose.

Considering the small number of skulls immediately at my disposal, and the very defective or otherwise doubtful condition of some of them, I was obliged to take my pictures from such of them as gave the best indications of regular development. But I can by no means assert that in all respects they represent typical forms, or that my statements do not admit of great corrections. This the future only can decide, and my work will have fulfilled its aim if it hastens the bringing on of new and better material.

For the present I can only make the single assertion that, so far as we have a distinct view of the physical relations, *as few evidences appear of a real affinity between the Tamils and the Vęddás as between the Tamils and the Siṇhalese.*

This, however, does not decide the question as to whether there is a Dravidian element either in the Vęddás or the Siṇhalese. The present Tamils of Ceylon are in nowise typical representatives of all the tribes of Hindústán which are usually embraced in the term "Dravidas." Indeed, we find that in the further pursuit of a study of the latter so many varieties among them have come to light, that it has not yet even been proved with certainty which of the so-called Dravidian tribes are most closely related, and which are to be looked upon as the purest. But we now know that in the course of centuries "Malabars" from different regions on the coast of the peninsula of Hindústán, who made invasions and settlements in Ceylon, came, not alone from the nearer points on the coast, but also from quite northern districts. Before expressing a decided judgment all these tribes must be compared in turn.

It would not be here in place to institute a comparison of this kind, and the material at present is not sufficient. I will limit myself to calling attention to the statements of Mr. Callamand* regarding the Maravars, and the introduction of a single example. Through the mediation of Mr. F. Jagor

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* Revue d' Anthropologie, 1878, sér. II., T. I., p. 607.

I received from Dr. Burnell three skulls from the lower castes of Tanjore, therefore directly from the region corresponding to the Chóla or Solí of the Sinhalese annals.

Of these three the one which is distinguished by a large back palatal fissure proves so aberrant in form that it must be excluded as pathological. The other two, however, are very similar, except in the certainly very different form of the palate, as we see in the main indices :—

Index of breadth	...	73·3	...	75·4
Index of height	...	76·1	...	78·2
Orbital index	...	85·3	...	80·4
Nasal index	...	51·0	...	50·0
Palatal index	...	73·0	...	90·0

Strictly speaking, only the height and the indices of the nose agree well, both skulls being hypsicephalic and mesorrhine. On the other hand, we find in all the other indices differences which make it necessary to assign these skulls to other categories, according to the special relations considered. One is dolichocephalic the other mesocephalic. Which is here typical ? One is hypsikonch the other mesokonch, one leptostaphyline the other brachystaphyline. According to which shall we decide ?

To be sure we may say that in such limited comparisons chance figures often acquire a higher importance than belongs to them. The difference of the indices of breadth, for example, is just exactly as great (viz., 2·1) as the difference in the indices of height, and yet we are obliged to classify one skull as dolichocephalic and the other as mesocephalic, because accidentally the border figure between the two classifications is 75, and this is just between the two indices 73·3 and 75·4. On the other hand, the equally great difference in the indices of height does not prevent both skulls being assigned to the same category, viz., the hypsicephalic, since the number 76·1 as well as 78·2 is within the recognised extreme. Which of these figures is more, which less accidental I am unable to decide, and the calculation of an average from the single cases would not aid in the decision.

Nevertheless, I may say that the Tanjore skulls approach comparatively near the Tamils of Ceylon. In these I found also no small individual differences, and in the index of breadth, in fact, exactly the same, for the latter in the Tamil skulls amounted to 72, 74·8, and 75·3. But for the rest so many analogies present themselves between the two groups that in spite of the aberrant pathological skulls of Tanjore I consider it very probable that the people of Tanjore and the present Tamils of Ceylon are connected together.

But the kingdom of Chóli, or Solí, was even in ancient times a civilised state. Among its near neighbours early appeared the wild mountain tribes of the Nilagiris, remnants of which exist even to this day: as, for instance, the Kurumbas (Curumbars, Kurubas). They were subjugated by the kings of Chóla, and are found at present only in sparse numbers.* For a series of measurements and other investigations regarding these people we have to thank Mr. F. Jagor,† and also for some account of the half-savage Naya-Kurumbas living in the forests. Of the latter, Mr. Jagor has brought with him a skeleton, which is in the possession of the Berlin Anthropological Society. It belonged to a woman, and is remarkable for its extraordinary smallness and delicacy. It is 1,310 mm. in height, and of the skull we have the following indices :—

Index of breadth	...	...	74·6
Index of height	...	...	74·6
Index of face	...	...	81·8
Index of orbits	...	...	91·1
Index of nose	...	...	63·8
Index of palate	...	...	64·0

It is therefore an orthodolichocephalic chamæprosopic skull. Its capacity amounts to only 960 cub. cm., precisely the same nannocephalic measure which Mr. Flower gave of the smallest Vẹddá skull from Hunter's Museum, and which

* James Wilkinson Breeks. An Account of the Primitive Tribes and Monuments of the Nilagiris. London, 1873, p. 55.

† Zeitschrift für Ethnologie, 1879, Bd. XI., s. 54 *et. seq.*

he declares to be altogether the smallest human skull in this collection. In fact, this skeleton challenges comparison with the Veḍdás. The skull measurements show great similarity, whilst the Tamils from Ceylon as well as from Tanjore, especially in the index of height, vary essentially. The form of the face is different from both, as well from the Veḍdás as from the Tamils, but not different enough from the Veḍdás to justify an ethnological separation.

The measurements of Mr. Jagor among the living showed in the main similar proportions, although considerable single deviations appear which it is now impossible to account for. He found the Naya-Kurumbas throughout small in stature, and although among them were some very young individuals, the elder ones, especially the women, proved to have even smaller figures. I put the numbers briefly together :—

		Height of body. mm.		Skull index.
A man of 19 years	...	1,435	...	69·4
A girl of 15 years	...	1,402	...	71·0
A woman of 25 years	...	1,345	...	—
A woman of 45 years	...	1,305	...	82·4
Average of the women	...	1,350	...	—

The result in the case of the few wild Kurumbas is :—

		Height of body. mm.		Skull index.
A man of 18 years	...	1,492	...	72·6
A man of 23 years	...	1,515	...	73·1
A man of 27 years	...	1,529	...	80·2
A man of 30 years	...	1,523	...	69·8
A man of 50 years	...	1,589	...	—
Average of the men	...	1,529	...	—
A woman of 22 years	...	1,470	...	—
A woman of 50 years	...	1,410	...	—
Average of the women	...	1,440	...	—

How far the difference in bodily height is universal we cannot judge. At any rate, the women of both tribes are not

only smaller, but absolutely small. But the Kurumbas altogether must be called small. Mr. Ross King,* in his description of the aboriginal tribes of the Nilagiris, points out the Kurumbas as especially stunted creatures, "low in stature, they are also ill-made. They are among the most debased types of mankind." The indices of the head are, in both of the columns just given, dolichocephalic, and indeed to a very pronounced degree. The fact that we have in each column a brachycephalic head is perhaps to be ascribed to the difficulty in taking the measures of the living.

I do not enter any further into these investigations. For the present I only wished to show that the physical condition of the Tamils, including even those of the Coromandel coast, is not sufficient to represent perfectly the Dravidian type. Close beside them in the mountains of Hindústán we come upon other Dravidas who, to all appearance, are essentially different. Therefore, if one will search out the connection of the Vęddás, and perhaps of the Siṇhalese themselves, with Dravidian India, it would be advisable to go beyond the inhabitants of the coast and bring the mountain tribes into comparison.

But even here the researches will not end, for according to all probability the present mountain tribes are not the real aborigines of Hindústán. In the tradition, together with the Kurumbas, the Vedars are called the oldest inhabitants of Tondamandalam (Madras); and of them, it seems, it was said: "There were then no forts, only huts; no kings, no religion, no civilisation, no books; men were naked savages; no marriage institutions."† I will lay no weight on the name of the Vedars, which probably likewise signifies "hunters," although the mention of such aborigines is certainly noticeable. Further, in the oldest Indian epic, the Rámáyana, we are told of the fights of Vishṇu with fabulous Asurs, who we must imagine to have been the aborigines of Hindústán

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* Journal of Anthropology. London, 1870–71, p. 46.

† Breeks, *l. c.*, p. 55. Prichard, *l. c.*, IV., p. 182.

and Ceylon. Ráma himself, who is said to have come from Oude, makes war upon Ráwaṇá, king of Ceylon (Lańká), champion of the Yakkho and Rákshasas worship, and conquers him. Curiously enough a tradition has been preserved among the Hayas (Vayas, Haius) in Nepál that at the time when Ráwaṇá was slain they immigrated from Ceylon to the Dekkan, and later from thence to Samroanghar, and finally reached the mountains, which are their present home.* The Varalis, who inhabit the mountains of Konkan,† tell the same tale of their tribe. All these traditions are of course of no positive value for the diagnosis of the different tribes, but they must warn us not to decide our investigations among the aboriginal races of India and Ceylon simply on the ground of some crude linguistic indications, or the physical characteristics of a few better known tribes. All the same, whether the earliest inhabitants of Ceylon immigrated in boats over the small extent of sea which separates the Island from the mainland, or whether, as has been so often conjectured, and is rendered highly probable by the fauna of Ceylon, the Island was once a part of the continent, and as such inhabited by the same tribes, we cannot avoid the conviction that they stand in a close affinity to the aborigines of India.

Whether these were proto-Dravidian or even pre-Dravidian tribes we cannot with certainty decide at present.

The traditions, however far back they may go, with regard to this give very little light. Mr. Zimmer‡ has lately compiled from the books of the Vedas comprehensive accounts of the condition of the Indian people in past ages, but they hardly afford sufficient foothold to enable us to judge

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* Dalton. Ethnological Description of Bengal, re-published by Oscar Flex. Zeitschrift für Ethnologie, 1874, bd. VI., s.

† Louis Rousselet. Tableau des Races de l'Inde Centrale. Révue d'Anthropologie. Paris, 1873, t. II., p. 69.

‡ Heinrich Zimmer. Altindisches Leben. Die cültür der vedischen Arier. Berlin, 1879, s. 100 *et seq.*

of the Aryan condition. When the light-skinned Aryans from the Punjáb invaded the land, later called Hindústán, they found it already in the possession of numerous tribes of "dark-skinned" people. In the Vedas these same tribes are designated by the generic name of *Dasyu* or *Dasa*. A greater part of them, in proportion as the conquerors penetrated farther into the valley of the Ganges, were forced back on both sides to the mountains, northward into the Himálaya and southward into the Vindhya; those who remained behind were adopted as Sudras, thus becoming a part of the Aryan organisation. Hence nothing stands in the way of the assumption that the mountaineers in general belong to the aboriginal tribes. But neither does anything compel us to consider all these tribes of the Dasyu as homopholic. Indeed, one has recently begun to separate the Dravidian from the Kolarian* tribes, chiefly on account of language. Should we, in the face of such an important linguistic contrast, assume a physical similarity? In this matter the French anthropologists have advanced most audaciously. M. Rousselet† speaks most positively of an immigration of Thibetan tribes of the yellow race from the east, and another of Turanians from the west, before the Aryan invasion; but he assumes, as anterior to both, a population of Negritos. To the admixture of the latter with yellow tribes he first of all ascribes the origin of the proto-Dravidians, counting among these the Malers, the Konds, perhaps the Gonds, and only when fresh troops of invaders had again mixed with the proto-Dravidians, arose, in his opinion, the Dravidas or Tamils. They brought the snake-worship (Nagas) with them. On the other hand, from the immigration of the Turanians arose in the plains the Jats, in the mountains the Bhils, Minas, and Mhairs. He regards as the last remains of the primitive black population the scattered remnants of a small black people upon the high

* Dalton. Zeitshcrift für Ethnologie, a. a. O. S. 252.

† Rousselet, *l. c.*, pp. 55, 279, pl. III.

plateaus of the Amarkantak, who have become known under the names of Djangals, Puttuas, and Juangas. Curiously enough these are precisely such tribes as Sir E. Tennent and Mr. Bailey had already brought into comparison with the Vẹddás. But with regard to the Juangas (Dschuangs), Colonel Dalton states that they belong to the Kolarians; that their hair is rough, curly, and of a reddish brown colour, their cheek-bones prominent, faces flat, noses depressed, brows vertical but low. He gives the average height of the men as below 5 ft. and that of the women as about 4 ft. 8 in.* This description contains quite as many Mongolian as Negritian characteristics.

If I have many doubts, therefore, about admitting the distinctions of Mr. Rousselet, especially with regard to the assumption of a veritable Negrito race as the aboriginal race of India, I yet in nowise oppose the idea that the tribes of "black-skins" which the Aryans found established in the valley of the Ganges were mixed. How much Mongolian, Turanian, or Negrito blood flowed in their veins must remain for the present undecided. But it is certainly not improbable that a part only of the Dasyu were Dravidians, and that, even before the proto-Dravidas of Mr. Rousselet, pre-Dravidian tribes inhabited the land. Neither the Mongols nor the Turanians satisfactorily explain the stunted growth of the tribes of "black-skins," to whom even Pliny† alludes as "the pigmies inhabiting the mountains in the country of Prasiæ." All the information we have of them is unfortunately so imperfect as to permit of its being turned to account for every sort of opinion.

The Messrs. de Qutrefages‡ and Hamy have collected

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* The young women wear even now nothing but green leaves held together by a girdle. In so far they resemble the Wanni Vẹddás. But according to Mr. F. Jagor the women of the Korogars, some of the Gond groups, and the Chauchra in Hindústán, likewise wear no covering but leaves.

† Plinius. Nat. Hist., lib. VI., c. 22.

‡ A. de Quatrefages et Ernest T. Hamy. Crania Ethnica, V., p. 189.

accounts of the Negritos in India, from which they conclude definitely that genuine Negritos are still living in various parts of the country. I cannot esteem the evidence sufficient, although I will not deny that the question is open to discussion. I will give only one example as ground for my misgivings, which is not, however, taken from the Indians, but from genuine Negritos from the neighbourhood.

The so-called Negrito (or Mincopie) race which inhabits the neighbouring provinces to the east, and principally several clusters of islands and parts of Malacca (though they are in fact only scattered members of the tribe), show unquestionably by their dark complexion as well as smallness of frame, and particularly of the head, a striking approach to the Vẹddás and Kurumbas. As next to them in point of territory we must mention their near neighbours the "little blacks" who dwell in the Andaman Islands. In truth, Mr. Hartshorne* points to certain analogies between Vẹddás and Andamanese. But his proofs refer exclusively to single customs and peculiarities,—for instance, to the use of the bow and arrow, to their inability to count,—but nowhere rest upon physical grounds. It cannot be denied, however, that the Andamanese, through previously cited characteristics, are physically pretty closely related to the Vẹddás. In the measurements of Mr. F. Jagor† from the living I calculate the average height of the Andamanese :—

		mm.
17 males at	... ...	1,488
10 females at	... ...	1,416
27 Andamanese at	...	1,462

Among these the minimum is 1,350 with a man 20 years old, and 1,320 mm. with a woman of 24 ; the maximum 1,636 with a man 40 years old, and 1,504 mm. with a woman

* Journal of the Anthropological Institute of Great Britain and Ireland, 1878, vol. VII., p. 468.

† Zeitschrift für Ethnologie, 1876, bd. VII. Verhandl. der Anthropol. Gesellsch., s. 262. Journ. Anthrop. Inst., *l. c.*, p. 437.

20 years old. These are proportions in part even lower than the measure found for the Veddás, on the whole, however, coming to about the same.

As regards the capacity of the skull, it is on the average very small. I can state that according to measurements of Andamanese skulls, for which I am indebted to the kindness of Messrs. Macnamara and Man, they reach and even exceed the measure of nannocephaly which the Veddás and Kurumbas present. One of my skulls has a capacity of only 940 cub. cm., another shows 970, a third 1,050.

As great as the similarity in these figures is the difference in the form of the skulls. The Andamanese, as well as the Negritos generally, are in reality brachycephalic, and this one circumstance distinguishes them definitely from all the Ceylon races. If we add to this that their hair grows in spiral coils, and is to be classed with the woolly hair of the genuine negro, then every possibility disappears of a union with the Veddás, unless we assume that climatic influences have specially affected the hair. The complexion also presents considerable variation. Since most reporters call it pure black with the Andamanese, the Veddás are generally described as lighter, and even by the very trustworthy Davy as resembling the Sinhalese.

Even less analogy is found between Veddás and Australians. We may certainly point out that the hair and even the beard is somewhat like that of the Veddás; but one glance at the skull, and still more at the skeleton, of the Australian convinces us that here a great and unmistakable contrast exists. In spite of this Mr. Topinard* has recently emphasised the relationship of the Australians as well to the Veddás as to the Bhíls, Gonds, Khonds, Mundas, Kurumbas, &c. I call attention also in this connection to the sufficient number of reasons to the contrary adduced by his countryman, Mr. Callamand.†

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* Paul Topinard. L'Anthropologie. Paris, 1877, p. 521.

† Callamand, *l. c.*, p. 624.

Very much more complicated is the question whether Malay elements were not infused into the aboriginal population of Ceylon, which from the peculiar rigging of their boats has been concluded, not without substantial grounds. The fact that the Malays have extended their settlements much further, even as far as Madagascar, suggests the idea that they may have established upon Ceylon a kind of midway station. There are, however, no obvious physical indications of such a relationship, and I would therefore enter into no further discussion of this possibility, the less so since the generally assumed connection of the Malays with the ancient inhabitants of India impedes such investigation very greatly. The single recent statement of a physical resemblance between Siṇhalese and Malays, which I find is by an American missionary in China, Mr. Williams,* who observed in the former "a Malay expression of countenance."

From the foregoing discussion we assume as proved :—

(1.) *That manifold resemblances exist between the Veddás and the Siṇhalese, and that the origin of the Siṇhalese race from a mixture of Veddás and immigrants from India possesses great probability, as well upon historical as also upon anthropological grounds.*

(2.) *That the Veddás as well as the Siṇhalese in the main features are distinguished from the Ceylon Tamils, and equally from those of Tanjore (Chóla).*

(3.) *That, on the other hand, among the remnants of the old Dravidian or perhaps pre-Dravidian tribes of Hindústán we find even to-day evidence of analogies with the Veddás.*

Have the Veddás remained in the condition of the proto-Dravidians, or possibly pre-Dravidians, or have they in their isolation sunk to a lower state ? In other words, are they ethnologically to be turned to account in order to paint anew the picture of this primitive period ?

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* United States Exploring Expedition during the years 1838-42. Vol. IX. Pickering. The Races of Man. Philadelphia, 1848, p. 136.

In various places I have earlier demonstrated why it is not to be assumed that the Vẹddás have ever passed through a state of higher civilisation. If in spite of the reasons for such a conception, which to me seem conclusive, it may nevertheless be assumed that, owing to unfavourable outward circumstances, they have by degrees retrograded physically, and that their present low intellectual condition is the result of this physical deterioration, we should then be forced to represent them as a pathological tribe. The smallness and delicacy of their bones, above all the tiny size of their skulls, and, as a necessary result, the inferior capacity of their brains, might indeed suggest the hypothesis that they are a kind of cretin or microcephyle. Unquestionably the brain of the Vẹddá must be very small; direct and definite statements of how small we have not, and computation is very uncertain. Herr L. W. von Bischoff* has called attention in detail to the inexactness of the proposed method by which the weight of the brain is computed from the capacity of the skull. We can, however, by this method arrive at an approximate estimate, and I subjoin a few such calculations. The first is according to the method of Mr. Barnard Davis, who for the meininges and the vessels deducts 15 per cent. from the figures for the capacity of the skull, and claims the remainder as being the weight of the brain. The second is according to the direction of Herr von Bischoff, who ascertained that the capacity of the dry skulls was with males 11·9, with females about 8·8 per cent. cub. cm. larger than the weight of the brains expressed in grams. The weight of brain, therefore, would be with the Vẹddás, according to—

Davis's method.		Bischoff's method.
Males, 1,136 grams	... ...	1,177 grams
Females, 1,021 grams	... ...	1,105 grams

These numbers, however inexact they may be, still indicate a very striking contrast to the proportions of the brain

* Theodor L. W. von Bischoff. Das Hirngewicht des Menschen. München, 1880, v. 66.

in cultured races; indeed, the figures for the nannocephalic girl are so small that we have every reason to inquire whether these can be physiological relations. If we add to this the apparently very small capacity of the Veddás for mental development, the almost entire absence of all ideal forms of thought, the inability to count, and still more to calculate, the want of any sense of colour, the question suggests itself whether this is not mikrocephaly in the pathological sense? We can distinctly deny this suggestion. The small Veddá skull is as little to be considered microcephalic, in the technical sense, as the intellect of the Veddás is to be likened to the mental condition of microcephyles. The individuality of the Veddás is psychically fully developed. So far as their needs demand they have matured their capacities, and are able to take care of themselves and their children. They establish families, defend their estates (not very definitely limited to be sure), obtain for themselves, partly by great effort and cunning, the necessary food, and even associate, so far as unavoidable, with neighbours and strangers in a free way and as self-determined men. Enough; they are distinguished in all the main features from actual microcephyles.

Mr. Bailey* testifies expressly that madness and idiocy are rare among the Veddás, especially the latter. He says it is true they have the notion, that when one curses another madness overtakes the one cursed—a notion which prevails also among the Siŋhalese, who designate cursing as *katawaha* (" bad mouth," or " poison from the lips "). But insanity is nevertheless uncommon among them. This testimony is the more worthy of note since Mr. Bailey suggests the idea that, as the result of intermarriages with blood relations, beside a stunted body, diseases of the brain, idiocy, and epilepsy might be expected. But he finds nothing of the kind, and satisfies himself by imputing to the cause mentioned the lack of numerous descendants and dying out of the race, an

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* Bailey, *l. c.*, p. 295.

explanation which, considering the manifold unfavourable conditions under which the tribe live, may at least in this sweeping sense be open to question.

Real microcephaly in the pathological sense is found among the tribes of India. One of the most noticeable examples we know was communicated to the Berlin Anthropoligal Society by Dr. J. Wilson.* It concerns a sect of Fakírs, who administer the service in the temple of Shadowla, in the Punjáb, and who belong to the Suní Muhammadans; on account of their abnormal heads they were called Chuas or Chuhas ("rat-heads"). Of one of these Mr. Wilson has given us some measurements, which, though not showing exactly how they were taken, at any rate indicate much smaller proportions than are to be found among the Veddás. According to him, with one male Chua:—

		mm.
The diagonal circumference of the head (measured before the ears, across occiput) ...	19 inches =	482
The horizontal circumference (across occiput, ears, and frontal cavity)	17 inches =	431
The vertical circumference (right across from one ear opening to the other)	8 inches =	203

If we compare these figures with those of the Veddás the difference will instantly be clear. With the Chua the size diagonally amounts to less than the size horizontally of the Veddá skull No. 1, although the latter is not measured across the frontal cavities, but above them, and of course without any covering of flesh. Although Dr. Johnston asserts the impotence of these people, the sect has still, since the 16th century, continued to perpetuate itself in both sexes, and at some periods so vigorously that their number in the latter half of the 17th century reached a hundred heads. The temple is secretly visited by women, who, because of their

* Zeitschrift für Ethnologie, 1879, bd. XI. Verhandl. der Anthropol. Gesellsch., s. 237, 1880, bd. XII., Verhand., s. 12.

sterility, pass a night there, and consecrate their first-born, in advance, to the temple service. In the morning "they find a Chua at their side who is supposed to promote conception and beget Chuas." It will indeed be allowable to make another interpretation, and assume direct agency, wherein less impotent individuals than Dr. Johnston saw are employed; however it may be, this example very well illustrates the distinction between microcephaly and nanno-cephaly.

It may, therefore, without hesitation, be admitted that the impaired bodily and mental development of the Veddás is not owing to a really morbid condition, which as such might be hereditary, but rather to be regarded as a race-peculiarity. This, however, by no means excludes the possibility that favourable outward circumstances, especially better food, might produce a more complete development, and the body become larger and stronger, the skull and brain formation more perfect. In fact such cases appear among the Veddás, as is proved by examples previously given. A man of 1,638 mm. in height far exceeds the average, and though the one skull in the Davis collection which has a capacity of 1,614 cub. cm. may be considered as a kind of abnormity, there is still the other out of the collection in the College of Surgeons of 1,420 cub. cm., which (supposing it to be genuine) is a very noteworthy specimen.

It might follow from this that the Siṃhalese are civilised Veddás, who simply owe the superiority of their physical development to their better life. The Island of Ceylon had of old the reputation of affording the most favourable conditions for the existence of men, and was celebrated for the longevity of its inhabitants. "In Taprobanem," Palladius* writes, "ubi gens est Macrobiorum, namque eximia coeli temperie...ad ætatem 150 annorum senes durant." Saint

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* Palladius, *l. c.*, p. 3; *cf.* Plinius, Nat. Historia, lib. VI., c. 24. "Vitam homimum centum annis modicam."

Ambrosius even translates the Greek μακρόβιοι, "Beati." However, climatic and outward circumstances favour the Veddás too, and if in their peculiar conditions of life they in some degree approach the Rodiyas, still, as already mentioned, the latter have nowhere sunk to a physical degradation compared with that of the Veddás. But no one will deny that with good care both might attain to an incomparably more complete bodily development.*

In spite of this possibility of a more perfect growth, the Veddá race is still in reality, as in ancient days, of small stature—in fact one may even count it among the smallest of the living human tribes, and in a not very strict sense speak of it as a tribe of dwarfs. As a further corroboration of this, such tribes were scattered all over India. I have already referred to the Naya-Kurumbas. But beside these, people of small stature and little heads are not uncommon. Even the Sinhalese and Tamils of Ceylon have already afforded us examples of this. Herr von Bischoff† speaks of the brain of an Indian from Bukkur of 1,660 mm. in height, which weighed only 973 grams : he quotes at the same time an observation of Peacock's, who found in a native of mixed origin from Bombay a brain of 1,006 grams, whilst Mr. Clapham ascertains the weight of brain of a Bengalese to be 1,531 grams. In the collection of the Berlin Anthropological Society is the skull of a Poleyar, with a capacity of only 1,040 cub. cm.; that of a young native of further India, belonging to the caste of the oil merchants, having a capacity of 1,150, and his mother's of 1,100 cub. cm. Of the skulls from Tanjore which I mentioned one has 1,200 the other 1,255 cub. cm.

The nannocephaly of the Veddás, however little pathological it may be, compels us in nowise to go beyond the province of Indian ethnology to seek out analogies. Possibly

* Davy (*l. c.*, p. 107) states that among the Sinhalese there are more men than women; in the fishing towns, where the food is better, we find, however, as in Europe, that the case is exactly the reverse.

† Von Bischoff, a. a. O. S. 83.

India in ancient times was inhabited by tribes who bore a close relationship to these. With as little propriety as the present Hindús can be said to have sprung, and progressively developed from these more or less dwarfish aborigines, just so little does such a kind of explanation suit the connection of the Veddás with the Siṇhalese. As they have not descended from the Siṇhalese by regressive degeneration, neither surely have they been transformed by progessive evolution into Siṇhalese. That no such simple affinity exists is proved chiefly by the difference in the form of the face, to which all observers testify.

In truth, it was just the form of the face which caused all the earlier travellers to associate the Siṇhalese with the Europeans. Even Knox, as I have already mentioned, was of the opinion that no people in the world were so exactly like the Siṇhalese as the people of Europe. Cordiner asserts this quite as distinctly, calling attention particularly to the features, which means the face. If so fine an observer as John Davy, instead of this, says the Siṇhalese are wholly Indian, we can only conclude that all these designations point to the common Aryan character of the face. With Davy this is the less to be doubted since he speaks explicitly of the "Asiatic" form of the Siṇhalese skull (that is, of the capsule of the skull); when, directly to the contrary, almost all observers ascribe to the Veddá face a foreign and very frequently Dravidian type, it becomes clear that genealogical investigation must make the face a main object of study. If we now go back to the history there can be no doubt that *the Siṇhalese face is an importation from the Aryan province of the Indian continent.* The Rámáyana, as well as the Wijayo legend, affords direct confirmation of this. The latter, however, conveys at the same time an earnest warning not to be too one-sided in this opinion, for it speaks distinctly of an importation of Tamil women from "Mabar," from whom the king himself and his followers took wives.

If my view be correct *that the Vẹddás are a pure blooded, the Sinhalese a mixed race*, we may then leave the question out of consideration as to how far Ceylonese intervention, especially soil, food, and climate, has operated to determine the formation of the body. I wish only to touch briefly upon a few facts, the knowledge of which is not without significance in regard to this question. Even in the old document ascribed to Palladius, the sheep upon Taprobane are spoken of: "Oves illis crinitæ omnesque absque lana, lac suppeditant ubertim, latis caudis conspiciendæ (πλατείας ἔχοντα οὐράς).

Sir E. Tennent,* nearly two thousand years later, made the same observation in Jaffna; the sheep of the place had long hair, like goats, instead of wool. A similar influence of climate upon the hairy covering of the sheep is also testified of other places. It is asserted† that the native cats of Ceylon have an inferior appearance; they are said to be small, with thick close-clinging hair, little heads, retreating foreheads, but great pointed ears.‡ Any one disposed to assume a like influence of climate upon men might conclude that human beings also, especially the aborigines, who have dwelt longest upon the Island, have undergone a like change: for example, that the hair was originally woolly, the head and entire body larger. Then might approaches be sought to woolly-haired blacks, to Andamanese and Negritos, to Melanesians and even Africans. Before admitting such great alterations,

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* Tennent, *l. c*, II., p. 531. "The finest sheep in Ceylon are reared upon the dry plains which overlie the limestone and coral rock, on the northern and western coasts. These sheep, instead of being coated with wool, are covered with long hair, resembling that of goats, and the horny callosities that defend their knees, and which arise from their habit of kneeling down to crop the short herbage, serve to distinguish the Jaffna flocks from those of the other portions of the Island." I do not find it said that these sheep have fat tails.

† Charles Darwin. The Variation of Animals and Plants in the State of Domestication. Translated from the English by V. Carus. Stuttgart, 1868, vol. I., p. 122; vol. II., p. 369.

‡ *Id.*, vol. I., p. 57.

however, the facts must be assured. The story of the native cats deserves a more strict inquiry; it rests at present upon the solitary testimony of a botanist (Mr. Thwaites). The metamorphosis of the sheep, however, seems more firmly established, as it is supported by the authority of two wholly independent witnesses, separated from one another by quite a long interval of time; but it is confined, according to Sir E. Tennent, to a comparatively small district in the extreme north. Hence it appears to me we should hesitate before making an application of these experiences, gathered from the history of domesticated animals, to the savage inhabitants of Ceylon; at any rate until it is proved that the latter actually possessed in earlier times different physical characteristics. The present state of the hair plainly corresponds to the ἀπλότριχα of Palladius, and must therefore have been just as it now is for at least fifteen hundred years.

It is very certain that if we would pursue the search for the origin of the Veddás genealogically we must first turn our investigations to the savage, or half-savage tribes of India. This once clearly settled, room enough will still remain for conjectural anthropology. Even now speculation has gone pretty far. Mr. Hyde Clarke* brings the Kolarian and other further Indian tribes in connection with the African negroes; Col. Kincaid† places the Bhils with the Mongols; and Mr. Keane‡ strikes the Malays wholly out of the series of independent races, and believes the Caucasians to have penetrated in pre-historic ages not merely to further India, but even so far as Polynesia. It may be of service that such questions should be seasonably presented, especially at a time when the dying out of the savage races is imminent, and admonishes us to hasten the investigation. But after the questions have awakened interest, the warning must be reiterated not to draw any definite conclusions until a greater

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* Journal of the Anthropological Institute of Great Britain and Ireland, 1878, vol. VIII., p. 49.

† *Id.*, 1880, vol. IX., p. 406. ‡ *Id.*, 1880, vol. IX., p. 258.

amount of facts have been collected. First of all then, great stress must be laid on the importance of enlarging by every possible effort the ethnology of the Indians, in order to be able to investigate radically the tribe of "black-skins." Since a part of the Dasyu were transferred to the Sudras, and consequeutly included in the caste system of the Hindús, as the Veddás in that of the Sinhalese, it is not even possible to bring to a conclusion the physical anthropology of the Hindús and the Sinhalese until we have resolved the evidently very composite group of the Dasyu into its separate members. One such member is plainly the tribe of the Veddás. Their natural isolation upon an island has perhaps tended to preserve in them, rather than in related races upon the continent, their peculiar character, and made them an object by which to test the admissibility of the theories concerning the origin of the black Indians.

May the zeal of the observer know no flagging, that before the utter extinction of this already much depleted race, the language and customs, the physical and mental constitution, of the Veddás, may be in all particulars firmly established.

TABLES OF MEASUREMENTS.

I.—Skull and Face Measurements.

		VEDDA'S.			SINHALESE.			TAMILS.		
		1	4	5	1	2	? 3	1	2	3
		♀	♀	♂	♂	♂	♀	♂	♂	♂
Capacity	cub. cm.	1,250	1,025	1,360	1,110	1,200	1,250	1,155	1,260	1,200
Greatest length	mm.	177	165	185	178	181	172	175	179	170
Greatest breadth	,,	125·5	133	135	127	127	132	126	134	128
		Ps.*			Ps.	Pi.	Pi.	P.	P.	P.
Vertical height	,,	129	121	137	129	132·5	133	139	132	137·5
Auricular, meatus audit. to vortex ...	,,	107	104	120	113	106	116	116	113	117
Horizontal circumference ...	,,	485	465	508	482	493	472	477	490	473
Trans. vertical circumference ...	,,	283	286	300	298	293	305	305	308	305
Sagittal circumference, frontal bone ...	,,	120	115	134	119	124	121	117	134	130
Length of sagittal suture ...	,,	115	108	140	125	130	125	132	120	122
Sagittal circumference, squama occipital	,,	110	109	114	110	111	103	110	97	100
Whole sagittal arch	,,	345	332	388	354	365	349	359	351	352
Inferior frontal diameter ...	,,	95	91	93	93	92	88	88	92	88
Temporal diameter	,,	107·5	110	117	93	103	102	108	115	104
Parietal diameter, *tubera* ...	,,	119	123	120	122	116	123	115	120	122
Occipital diameter	,,	102	100	99	103	101·5	103	101	103	95
Mastoideal diameter, end ...	,,	96	94	103	96	98	93	105	95	93
Mastoideal diameter, *basis* ...	,,	110	111·5	122	115	115	111	120	119	112
Auricular diameter	,,	100	108	108	97	103	95	106	115	106
Horizontal length of occiput ...	,,	50	46	60?	53	54	52	48	42	46
Distance of nose-root from *foramen magnum*	,,	92	91	90	99	97	92	100	97	95
Distance of root of the nose from the ear opening	,,	96	94·5	99	102	101	95	101	104	99
Distance of nasal spine from *foramen magnum*	,,	81	—	—	96	86	83	91	87	88

Distance of nasal spine from ear opening	„	95	—	—	105	101	93	102	103	101
Distance of alveolar edge from *foramen magnum*	„	86	—	—	105	82 !	83	90	92	93
Distance of alveolar edge from ear opening	„	100	—	—	100	101 !	96	107	111	107
Distance of chin from *foramen magnum* ...	„	114	—	—	—	—	—	—	—	—
Distance of chin from ear opening ...	„	92·5	—	—	—	—	—	—	—	—
Height of face, A (from nasal root to chin)	„	101·5	—	—	—	—	—	—	—	—
Height of face, B (from nasal root to alveolar edge)	„	61	—	—	59	58 !	151	62	66	63
Breadth of face, A (jugal) ...	„	122	—	—	112	120	07	120	—	118
Breadth of face, B (*sut. zyg. max.*) ...	„	87	—	—	97·5	87	83	90	—	101
Orbits, height	„	33	—	—	30	34	30	32	35	32
Orbits, breadth	„	39	—	—	39	41	36	38	42	37
Nasal height	„	48	—	—	45	51	36	45	45	47
Nasal breadth, aperture ...	„	24	—	—	26	23·5	20	22	23	25
Palate, length	„	48	—	—	53	45 !	38	49	48 !	49
Palate, breadth	„	36	—	—	40	33 !	33	36	36 !	43
Distance maxillary angle ...	„	85	—	—	—	—	—	—	—	—
Distance maxillary joint ...	„	—	—	—	85	87	81	90	92	89
Facial angle	degrees	82	—	—	75	75	76	76	76	75

II.—Indices Computed.

Length to breadth index ...	mm.	70·9	80·6	73	71·3	70·2	76 7	72	74·8	75·3
Length to height index	„	72·9	73·3	74·1	72·5	73·2	77·3	79·4	73·7	80.9
Breadth to height index	„	103·5	90·9	101·4	101·5	104·3	100·7	110·3	98 5	107·4
Auricular index	„	60·4	63	64·9	63·5	58·5	67·4	66·3	63·1	68·8
Middle facial index	„	50	—	—	52 6	—	47·6	51·6	—	53·4
Orbital index	„	84·6	—	—	76·9	82·9	83·3	84·4	83·3	86·4
Nasal index	„	50	—	—	57·7	46	55 5	48·8	51·1	53·1
Palatal index	„	75	—	—	75·4	—	86·8	90	—	87·7

* The mark P. signifies that the greatest breadth was taken at the parietal; Ps. at the *tubera* (upper parts); Pi. at the lower parts.

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ERRATA IN VOL. VIII., No. 29.

Page 248, "Remarks" column, "Sweetness" should be in a line with *rahatiyá* and not with *kiri-kabalu*.

" 254, " " *for* "kinds" *read* "kind."

" 254, " " after each of the words *kalugedi*, *maha*, *et*, *há*, and *rilá*, there should be a dash (—), representing the word *embayá*.

" 259, " " *for* "crying from *alu*" *read* "crying" from *alu*.

" 266, note †, "*At the Birth of Buddha*" should not be in italics, and there should be a comma, not a full stop, after it.

" 269, line 13 from bottom, *for* "On-king" *read* "Ox-king."

" 269, line 12 from bottom, *insert* "your" between "Lend" and "strength."

" 306, note ‡, the last paragraph beginning "Winslow," &c., should appear as a note to the words "At one of the hours fixed for this purpose," on opposite page.

" 311, line 17 from top, *for* "old" *read* "ola."

" 311, note ‡ should appear as a note to the sentence ending "offered as a *pongkal* to the deity." The original note to "facing north" has been omitted. It should run: "*vide ante*, p. 307, note †."

" 315, lines 11 and 12 from top, "*kávatcheyya*" should be within parentheses, and "the heap" should not be within parentheses.

" 316, note ‡, *for* "A hut is like" *read* "A hut-like."

" 317, line 12 from bottom, "*Pillaiyár*" should be without parentheses.

" 320, line 22 from bottom, *for* "Private" *read* "Saivite."

" 325, line 3 from bottom, *for* "ówita" *read* "óvita."